Central Valley Habitat Joint Venture Implementation Plan

A Component of the

North American Waterfowl Management Plan

February 1990

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PREFACE

The Central Valley of California is the most important wintering area for waterfowl in the Pacific Flyway, supporting 60 percent of the total population. Historically, the Central Valley contained more than 4 million acres of wetlands; now only 291,555 acres remain.[1] The primary cause of wetland loss was conversion to agriculture, flood control and navigation projects, and urban expansion.

The Central Valley Habitat Joint Venture (CVHJV [2]) Implementation Plan is focused on reversing the decline of California wetlands. On June 8, 1989, President Bush issued a policy statement calling for no net loss of wetlands. The Joint Venture fully supports the no net loss concept but to achieve the objective of the North American Waterfowl Management Plan (NAWMP) requires going beyond this level and creating a net gain in Central Valley wetlands.

When completed, the CVHJV will: 1) protect 80,000 acres of existing wetlands through fee acquisition or conservation easement; 2) restore 120,000 acres of former wetlands; 3) enhance 291,555 acres of existing wetlands; 4) enhance waterfowl habitat on 443,000 acres of private agricultural land; and 5) secure 402,450 acre-feet of water for existing State Wildlife Areas, National Wildlife Refuges, and the Grasslands Resource Conservation District. Total capital investment to achieve these objectives is estimated at $528 million with annual operation and maintenance costs estimated at $29 million (Appendix II).

The CVHJV will not be implemented at the expense of other native/sensitive habitats e.g., vernal pools, remnant native grasslands, etc. Individual problems will be addressed in site specific plans, particularly for restoration and enhancement activities.

[1] In June, 1989, the U.S. Fish and Wildlife Service published Wetlands of the California Central Valley: Status and Trends (1939 to mid-1980's) which reported there were 318.9 thousand acres of freshwater wetlands in the Central Valley in the mid-1980's. Included in this figure are some playa and deep water habitats that the CVHJV chose not to include, therefore the discrepancy.

[2] See Appendix I for a glossary of terms and acronyms.

ACKNOWLEDGMENTS

The Implementation Board of the Central Valley Habitat Joint Venture acknowledges the following people who developed, authored, and edited the CVHJV Implementation Plan:

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Each of these authors had the collective help of several dozen persons from both the public and private sectors. To these individuals, the Board extends its thanks and appreciation.

The U.S. Fish and Wildlife Service, Sacramento Endangered Species Office, helped develop Appendix IV.

EXECUTIVE SUMMARY

The Central Valley of California is the most important waterfowl wintering area in the Pacific Flyway, supporting about 60 percent of the total population. In pristine times, four million acres of wetlands, mostly surrounded by grasslands and riparian areas, provided ideal wintering and breeding habitat for waterfowl and other wildlife that flourished throughout the region. These wetlands provided a wide variety of benefits including fish rearing and passage, groundwater recharge, and sediment control among others (Appendix III).

Since the mid-1950's, duck populations have shown sporadic fluctuations related to weather and land-use changes. However, in the late 1970's populations started to decline, and by the mid-1980's, fall flights were approximately 30% below long-term averages. Much of this reduction can be attributed to habitat loss (including drainage and intensive agriculture) that has reduced the quantity and quality of wetlands and surrounding upland nesting habitat. This loss was greatly accelerated in the 1980's when a severe, prolonged drought in Prairie Canada and the north-central United States aided widespread wetland drainage for agriculture. In the Central Valley, 95% of the historic wetlands have been lost.

The primary focus of the NAWMP and the CVHJV is waterfowl. However, achievement of the CVHJV objectives will benefit a wide array of other wetland species including shorebirds, wading birds, amphibians, reptiles, fish, mammals, invertebrates and plants. Fifty-five percent of the threatened and endangered species in California are associated with wetlands; so implementation of the CVHJV will have major benefits to this group of organisms (Appendix IV). In addition to benefitting plants and animals, the protection, restoration, and enhancement of wetlands, the CVHJV will also provide many environmental and public values as well (Appendix III) .

Concerned over the decline in duck populations**,** the United States and Canadian Federal governments developed and signed the North American Waterfowl Management Plan (NAWMP) on May 14, 1986. The NAWMP provides a broad framework for waterfowl conservation and management based on populations and habitat goals needed to meet public demand. The NAWMP established a continental breeding population goal of 62 million ducks, including 8.7 million mallards and 6.3 million northern pintails, and a fall flight of 100 million ducks during years of average environmental conditions. These goals are based on average continental duck populations from 1970-79 in surveyed areas.

Implementation of the NAWMP is the responsibility of designated joint ventures, in which agencies and private organizations collectively pool their resources to solve waterfowl habitat problems. The California Central Valley Habitat Joint Venture (CVHJV) was formally established by a working agreement signed in July, 1988. The CVHJV is guided by an Implementation Board comprised of representatives from the California Waterfowl Association, Defenders of Wildlife, Ducks Unlimited, National Audubon Society, Waterfowl Habitat Owners Alliance, and The Nature Conservancy. Technical assistance and advice is provided to the Board by the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), California Department of Food and Agriculture, and other organizations and agencies.

At objective level, the CVHJV's annual contribution to the continental breeding population will average 490,000 breeding ducks, including 300,000 mallards, and a fall flight of 1 million ducks. Upon completion of the CVHJV objectives, the Central Valley will support 4.7 million wintering ducks, including 2.8 million pintails. Because they are so dependent on the Central Valley, wintering pintails will be given special attention in the CVHJV.

The goal of the CVHJV is to "protect, maintain, and restore habitat to increase waterfowl populations to desired levels in the Central Valley of California consistent with other objectives of the NAWMP." Six objectives were developed by the Implementation Board to achieve this goal:

1. Protect 80,000 additional acres of existing wetlands through acquisition of fee-title or perpetual conservation easements.

2. Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by National Wildlife Refuges (NWR's), State Wildlife Areas (WA's), and the Grasslands Resource Conservation District (GRCD).

3. Secure Central Valley Project (CVP) power for NWR's, WA's, GRCD, and other public and private lands dedicated to wetland management.

4. Increase wetland areas by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easement.

5. Enhance wetland habitats on 291,555 acres of public and private lands.

6. Enhance waterfowl habitat on 443,000 acres of agricultural lands.

This implementation plan was developed by stepping down the six specific objectives into detailed chapters, which are summarized on the following pages.

Habitat Acquisition Objective

In 1985, only 291,555 acres of wetlands important to waterfowl remained in the Central Valley. Of these, 118,900 acres were unprotected. To accomplish this objective, the CVHJV proposes to protect 62,060 acres through conservation easements at an estimated capital cost of $38.3 million and 17,940 acres by fee acquisition for an estimated $45.0 million (Appendix II). Annual operation and maintenance costs are estimated to be $1.55 million for easement lands and $1.79 million for fee acquisition lands. Priorities will be: 1) habitat with high waterfowl value based on historical waterfowl use patterns, 2) wetlands with lower waterfowl use but adjacent to restorable wetlands, and 3) wetlands with lower waterfowl use not adjacent to restorable wetlands. Any acquisition, either fee or easement, must have a firm water supply.

Water and Power Objectives

Because the objectives for water and electrical power for wetland management are closely related, they are treated collectively in determining strategies and implementing actions. Water and power objectives are limited to State WA's, NWRIs, and the GRCD where a total deficit of 402,450 acre feet of firm water supply presently exists. Severe water shortages also exist on many privately owned lands besides those in the GRCD. These needs are included in actions for the acquisition, restoration, and enhancement objectives.

Eleven strategies have been identified for accomplishing these objectives. The preferred solution is to initiate legislation to reauthorize CVP to include wildlife as a project purpose. This legislation would also authorize and direct U.S. Bureau of Reclamation (BOR) and the Western Area Power Administration to provide needed water and power, including any needed development costs under contract with CDFG, USFWS, and GRCD. Efforts have already begun to initiate this legislation. Total capital costs for this objective are estimated at $35.4 million based on a full ground water alternative. Annual operation and maintenance cost plus the cost of delivered surface water is estimated to be $6.9 million.

Wetland Restoration Objective

Since 1986, when the NAWMP was initiated, about 10,000 acres of wetlands have been restored in the Central Valley, 7,300 of which are protected by easements or fee-title purchase. Thus, to meet this CVHJV objective, an additional 112,700 acres of wetlands need to be restored and protected. About 75% (84,525 acres) of the proposed acreage is targeted for private-ownership using perpetual conservation easements as incentives. The remaining 25% (28,175 acres) will be acquired in fee title by USFWS and CDFG. Firm water supplies must be available before any restoration, either fee or easement, will be considered. The total estimated capital cost for restoration is $315.0 million and the annual operation and maintenance cost is estimated to be $6.90 million.

Wetland Enhancement Objective

Of the 291,555 wetland acres remaining in the Central Valley, 204,790 are in private ownership, 43,745 in State ownership, and 43,020 in Federal ownership. To achieve this objective, 291,555 acres are targeted for enhancement using a variety of strategies including: 1) supplementing existing operation and maintenance programs; 2) supplemental incentive payments to private landowners; 3) disease control; 4) technical assistance.; and 5) coordination with other agencies and organizations such as county agricultural departments and irrigation districts. Total estimated annual cost for this objective is $18.9 million ($65/acre).

Agricultural Lands Enhancement Objective

Wetlands in the Central Valley including those proposed in the Wetland Enhancement Objective will not supply adequate food and cover for the desired populations of wintering waterfowl as set forth in the NAWMP. If the desired numbers of waterfowl are to winter and breed in California, 332,300 acres of privately owned grain fields and 110,800 acres of upland nesting habitat must be enhanced to meet resource needs.

This objective will be met using a variety of strategies including: 1) existing programs under the 1985 Food Security Act; 2) incentive payments to cooperating landowners who conduct various land use practices favorable to waterfowl; and 3) outreach extension and education programs to the agricultural community conducted by various agencies and organizations. The total estimated annual cost for this objective is $7.2 million to be paid by the Federal, State, and private sectors.

Conclusion

Overall, the CVHJV is targeted for completion by the year 2000. When completed, 80,000 acres of existing wetlands will be protected through perpetual easements or fee-title purchases; 120,000 acres of historic wetlands will be restored and protected; 291,555 acres of existing wetlands will be enhanced; 402,450 acre feet of water will be secured for existing Central Valley NWR's and WA's; and 443,000 acres of private agricultural land will be enhanced annually for feeding and nesting waterfowl. The estimated capital investment for attaining all objectives is $528.7 million. Annual operation and maintenance costs are estimated to be $29 million. In addition, meeting the water and power objectives will require new Federal legislation.

The CVHJV Implementation Plan will be updated with scheduled NAWMP revisions or as otherwise appropriate. Such updates will occur at least every five years.

INTRODUCTION

The North American Waterfowl Management Plan (NAWMP) was signed on May 14, 1986, by the Secretary of Interior for the United States and the Minister of Environment for Canada. The NAWMP provides a broad framework for waterfowl conservation and management in North America through the year 2000. Population objectives for key species were identified in it and habitat goals to sustain these populations were established. Although the 1986 agreement was originally only between the United States and Canada, a subsequent memorandum of understanding for the conservation of migratory birds and wetlands was signed by the national conservation agencies' directors of Canada, Mexico, and the United States on March 16, 1988. This international memorandum of understanding will also contribute to achievement of the international goals defined in the overall NAWMP.

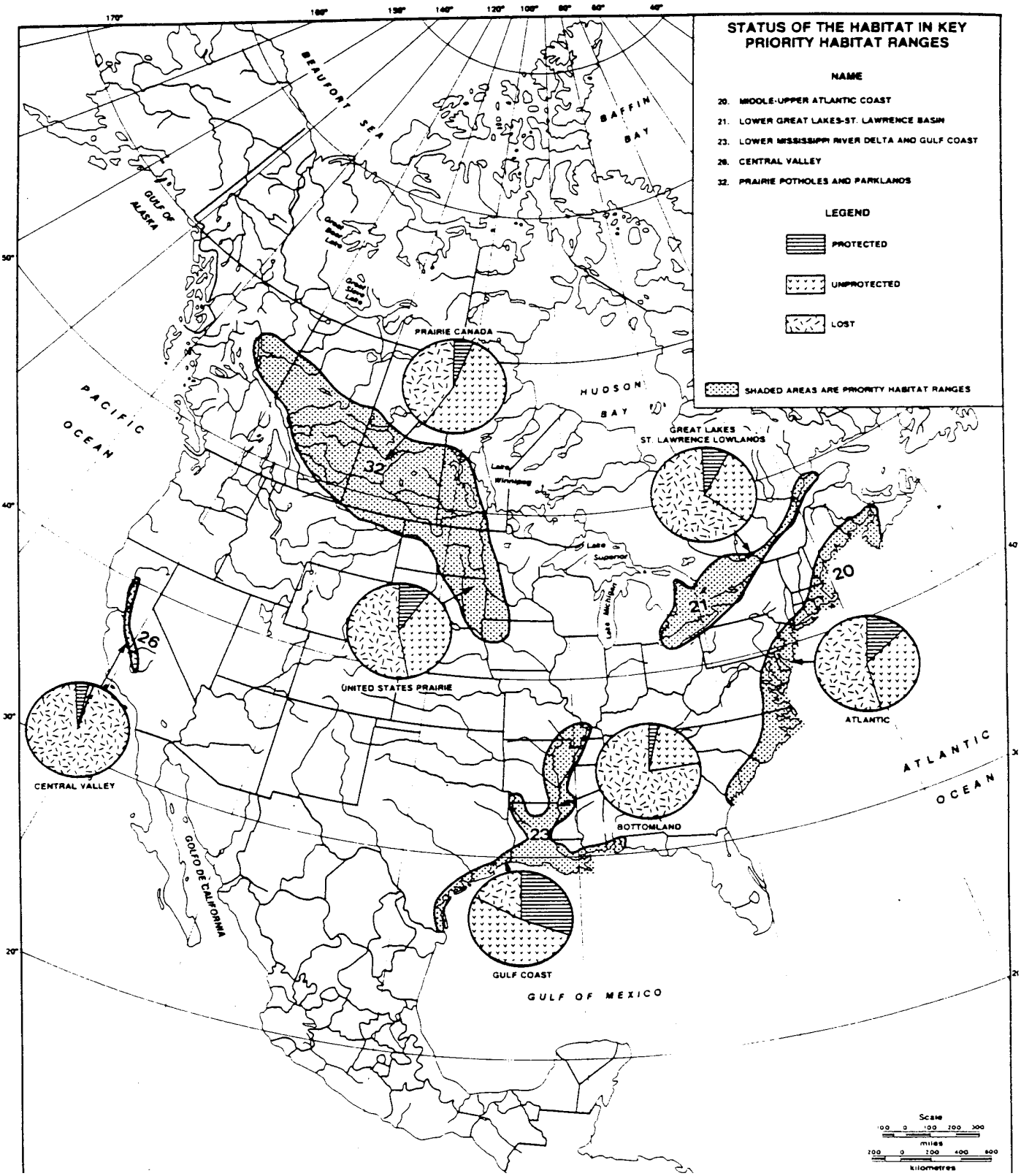
On December 13, 1989, President Bush signed the North American Wetlands Conservation Act which obligates annual appropriations for the implementation of the NAWMP. Funding for the Act includes; 1) interest from obligations held by the U.S. Treasury as part of the Federal Aid in Wildlife Act (Pittman-Robertson) (16 U.S.C. 669b) of September 2, 1937; 2) migratory bird fines, penalties, and forfeitures; and 3) direct appropriations.

The NAWMP seeks to restore and maintain the diversity, abundance, and distribution of waterfowl that occurred during 1970-79. Population objectives for 20 species of ducks, 18 species or subspecies of geese divided into 27 management populations, and 2 species of swans are identified. The NAWMP further seeks to assure sufficient habitat to support 62 million breeding ducks, a fall flight of 100 million ducks, and 6 million wintering geese and swans. Updating of the NAWMP will occur at five-year intervals beginning in 1990.

In the NAWMP, broad recommendations are made for wetland and upland habitat protection, restoration, and enhancement; duck harvest, overall waterfowl population management, subsistence hunting and research. The major focus, however, is on ducks and their habitat. Two of the NAWMP's seven habitat objectives relate to the general maintenance or rehabilitation of 34 major waterfowl habitats. Five of the seven priority objectives are specifically focused on seven habitat areas (six in US; one in Canada) of the highest international priority (Figure 1). These seven areas are the objects of the initial joint ventures which will receive priority planning and funding. The Central Valley of California is one of these seven priority areas.

Within the priority areas, mallards, northern pintails and American black ducks receive special attention where appropriate. The major strategy for implementing the NAWMP is to establish specific habitat joint ventures where agencies and private organizations collectively pool their resources to address waterfowl habitat problems. Each joint venture will develop implementation plans to address specific needs of each area.

Figure 1. Status of waterfowl habitat in priority breeding and wintering areas of Canada and the United States.



The California Central Valley Habitat Joint Venture (CVHJV) was organized on February 22, 1988, at a meeting

initiated by the U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG). Representatives from the California Waterfowl Association (CWA), Defenders of Wildlife (DOW), Ducks Unlimited (DU), National Audubon Society (NAS), Waterfowl Habitat Owners Alliance (WHOA) and The Nature Conservancy (TNC) participated in the meeting, and eventually became the Joint Venture's Implementation Board. Technical assistance is provided to the Board by USFWS, CDFG, and the Trust for Public Lands (TPL) who collectively are ex-officio board members.

A Waterfowl Habitat Technical Committee (Technical Committee) was established with biologists from the public agencies and private groups. The Technical Committee provides the main technical support for the overall CVHJV. The initial planning guidance for the CVHJV was derived from; 1) the NAWMP's Habitat Objective 3, "To improve the quality of publically managed habitat and protect and restore 80,000 additional acres of wintering habitat for northern pintails and other waterfowl in the Central Valley of California"; 2) the USFWS's updated Concept Plan for Waterfowl Wintering Habitat Preservation in Central Valley California (1987), and 3) information available at the local level.

Historical and Present Situation

Wetlands and agricultural lands in the Central Valley support 60 percent of the waterfowl wintering in the Pacific Flyway. Of special importance, greater than 65 percent of all pintails in the United States use the Central Valley. These habitats, along with adjacent uplands and riparian areas, also provide habitat for many other plants and animals. Sandhill cranes, American white pelicans, white-faced ibis, northern harriers, short-eared owls, double-crested cormorants and many other upland, passerine, and wading birds share these habitats. Threatened, endangered, and candidate species recognized by the State and Federal governments also are associated with many of these remaining habitats. Federally listed endangered species in the Central Valley include the Aleutian Canada goose, southern bald eagle, peregrine falcon, delta green ground beetle, palmate-bracted birds beak (plant), and Solano grass. The valley elderberry longhorn beetle is a Federally threatened species, and the State threatened list includes the western yellow-billed cuckoo, greater sandhill crane, and California black rail. A long list of Federal candidate plant and animal species are also under review (Appendix IV).

When first settled, 6,000 miles of stream, river, and associated riparian habitats complemented wetlands in the Central Valley. Today, because of major water developments, less than 950 miles of riparian woodland remain and fish and wildlife populations have declined dramatically along with their habitats. Some passerine bird species that used the riparian zones or wetlands for nesting were particularly affected. The western yellow-billed cuckoo, willow flycatcher, and yellow warbler are riparian passerine species that have experienced serious declines in recent times. Wetland nesting tricolored blackbirds have shown similar downward trends.

The importance of the Central Valley to wintering waterfowl has gained strong recognition in continental waterfowl management in recent years. Also, Californians now recognize the broad public values of wetlands and associated habitats and are launching efforts to reduce or reverse habitat losses. A State legislative action (SCR 28) in 1979 mandated that the existing wetland acreage in California be increased 50 percent by the year 2000. Since 1984, Californians passed two ballot measures (Propositions 19, 70) and a tobacco tax initiative (Proposition 99) to help finance programs for wildlife and habitat acquisition and enhancement. Other legislative and general public support activities are ongoing.

Wetland habitat, however, continues to decline from the original 4 million acres once present in the Central Valley to approximately 291,555 acres present today (Figure 2). About 30 percent of the remaining wetlands are within National Wildlife Refuges (NWR's) and State Wildlife Areas (WA's); the remaining 70 percent are privately owned and managed primarily as duck hunting clubs. About 40 percent of the private wetlands are protected through State legislation, Federal perpetual easements, or by conservation organizations. The remaining 119,000 acres of wetlands are unprotected and are a priority objective. In addition, there is a strong need to work more closely with the agricultural industry, primarily rice growers, in cooperative management efforts to meet the total food needs of waterfowl and enhance nesting habitat opportunities.

Recent research findings show that high levels of selenium in return-flow irrigation water have compounded overall waterfowl habitat problems in the southern portion of the Central Valley. The quantity and quality of irrigation return flows have changed drastically as tile (subsurface) drainage increased and concentrated contaminants. Combining tile-drainage outflows with surface-water irrigation return flows has contaminated previously acceptable surface-water supplies and made them unusable for waterfowl habitat management. The need for firm-yield water supplies for State, Federal and private lands managed for waterfowl has not been adequately addressed in past Federal and State water resource development projects. The U.S. Bureau of Reclamation's Central Valley Project (CVP) and California Department of Water Resource's (DWR) State Water Project (SWP) transect the valley and, combined, represent one of the most sophisticated water management systems in the world (Figure 3). Historically, these projects served the needs of agriculture, power, and municipal- industrial water users while fish and wildlife needs have received minimal attention. Waterfowl management areas have traditionally operated primarily by using intermittent-yield CVP water supplies (surplus water in wet years) and irrigation return flows.

Deterioration of water quality in irrigation return flows has compounded the general wetland loss situation and increased the likelihood of disease outbreaks. Consequently, birds returning north to breed are often in poor physical condition with an attendant reduction in breeding success.

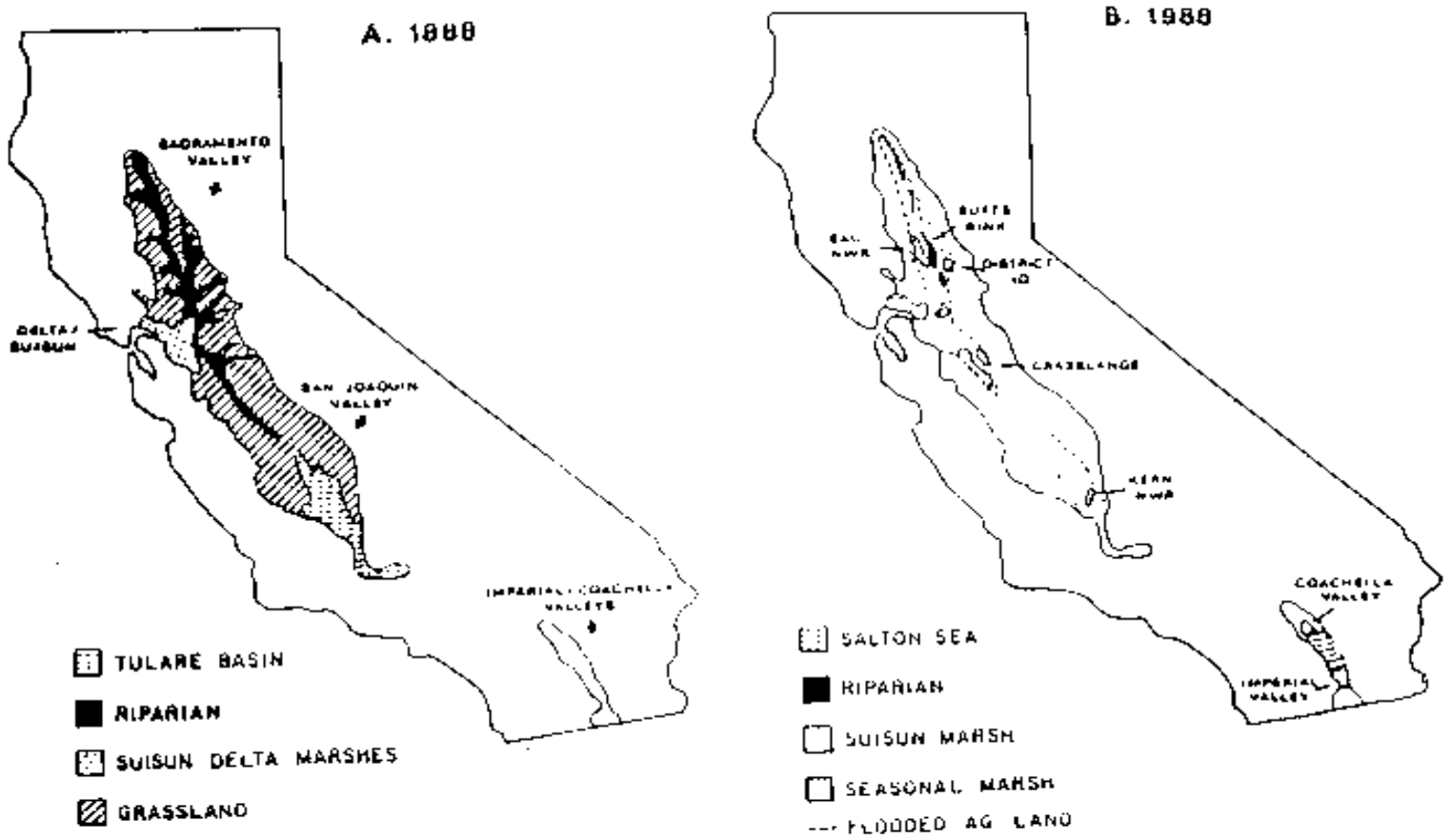


Figure 2. Valleys of California and the distribution of a) historic and b) current wetlands and grasslands. Adapted from Roberts et al. 1977. U.S. Fish and Wildlife Service 1978. Madrone Associates 1980, and Barry 1981

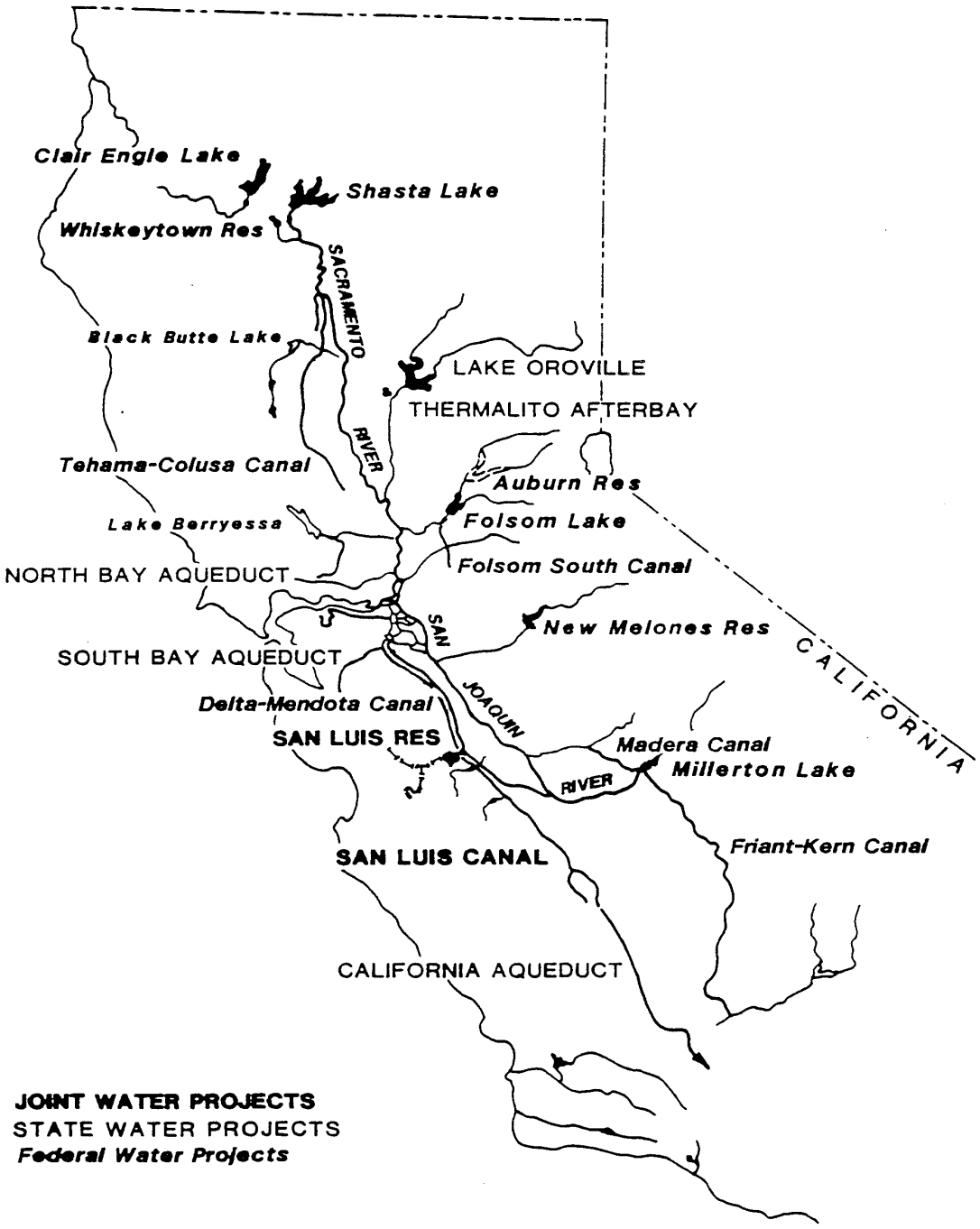


Figure 3. State and Federal water projects in the Central Valley of California and surrounding vicinity.

Objectives

Based on historical and current situations, a primary goal and six supporting objectives were developed for the Central Valley. They are:

Our primary goal is to protect, maintain, improve, and restore habitat to increase waterfowl populations to desired levels in the Central Valley of California consistent with other objectives of the NAWMP.

Objectives:

1. ***Protect 80,000 additional acres of existing wetlands through acquisition of fee-title or perpetual conservation easements.***

2. ***Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by the NWR's, State WA's, and the GRCD.***

3. ***Secure CVP power for NWR's, State WA's, GRCD, and other public and private lands dedicated to wetland management.***

4. ***Increase wetland areas by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easements.***

5. ***Enhance waterfowl wetland habitats on 291,555 acres of public and private lands.***

6. ***Enhance waterfowl habitat on 443,000 acres of agricultural lands.***

After the goal and objectives were agreed upon**,** specific Working Committees for each objective were formally established in a working agreement signed in July, 1988. The Waterfowl Habitat Technical Committee and the Working Committees provided the main technical support for the development of the CVHJV Implementation Plan. This action plan presents background, implementation strategies, and administrative and coordination recommendations for the six objectives relative to the nine drainage basins of the Central Valley (Figure 4.) These basins are all small drainage components that feed into either the south-flowing Sacramento River or the north-flowing San Joaquin River. In turn, these two rivers meet to form the Sacramento-San Joaquin Delta (delta) where their waters commingle before flowing to San Francisco Bay.

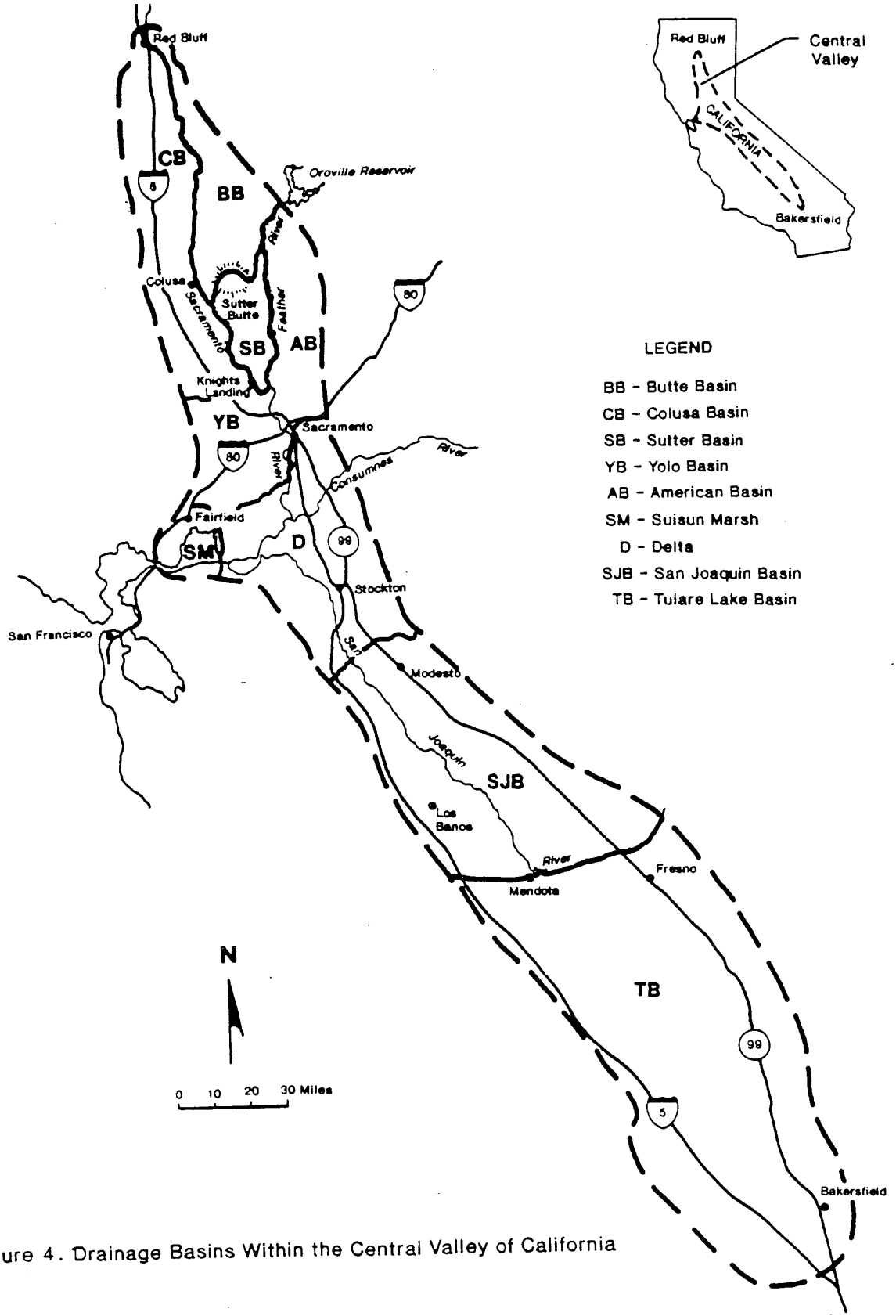


Figure 4. Drainage Basins Within the Central Valley of California

Description of Basins

California's Central Valley consists of the Sacramento Valley in the north and the San Joaquin Valley in the south. The Valley extends approximately 400 miles from Red Bluff in the north to Bakersfield in the south (Figure 4).

The Sacramento River flows south and drains the Sacramento Valley. Within the valley are the Butte, Colusa, Sutter, Yolo, and American Basins.

The San Joaquin River flows north and drains the San Joaquin Valley. Valley comprises the San Joaquin and Tulare Basins.

The Sacramento and San Joaquin Rivers converge at the Delta southwest of Sacramento where the commingled waters flow west past the extensive Suisun Marsh to San Francisco Bay.

The climate of the Central Valley is typical Mediterranean; cool and wet in winter, and hot and dry in summer. Average annual rainfall is 15 to 22 inches in the northern part of the Valley and only 6 inches in the southern part. Most rain falls between November and March. Below-freezing temperatures occur less than 15 days annually. Summer temperatures regularly exceed 100°F.

Butte Basin

The Butte Basin extends from Red Bluff in the north to the Sutter Buttes in the south, the Sacramento River on the west and the Feather River on the east (Figure 5). The Basin contains nearly 1,000 square miles (80 miles long and about 12 miles wide).

There are 11,363 acres of publicly owned and managed waterfowl habitat in the Butte Basin, including the Butte Sink NWR (Bean Field, 733 acres), Gray Lodge WA (8,375 acres) and the newly acquired Upper Butte Sink unit of Gray Lodge WA (Schohr Ranch, 3,750 acres). The Gray Lodge WA is natural habitat in a complex of wetlands and associated uplands whereas the Upper Butte Sink Unit and the Bean Field are mostly agricultural land that will be restored to natural habitat in the future. Hunting clubs maintain more than 30,000 acres of habitat in a normal year. Of this total, about 18,000 acres are natural wetlands and 12,000 acres are harvested rice fields flooded for hunting. A large proportion of the hunting clubs with natural habitat are concentrated in the Butte Sink (42 clubs with a total of 11,130 acres of wetlands and associated uplands). Currently, 5,350 acres of private duck clubs are permanently protected by USFWS Conservation Easements in the Butte Basin. The National Audubon Society owns and manages another 500 acres of wetlands at the Paul L. Wattis Audubon Sanctuary west of Butte Creek.

Significant wetland habitat in the north Butte Basin includes the Vina Plain, an area of native grasslands north of Chico. The Thermalito Afterbay near Oroville also provides important resting habitat for waterfowl. The upper basin includes extensive land interspersed with levees, irrigation canals and drainage ditches.

Riparian habitat occurs along the Sacramento River and Butte Creek, and scattered natural wetlands occur on Llano Seco (Parrot) Ranch and along Butte Creek. The Sacramento River NWR has been approved for as much as 18,000 acres of riparian habitats lying between Red Bluff and Colusa. Negotiations for acquisition of approximately 60 parcels are ongoing.

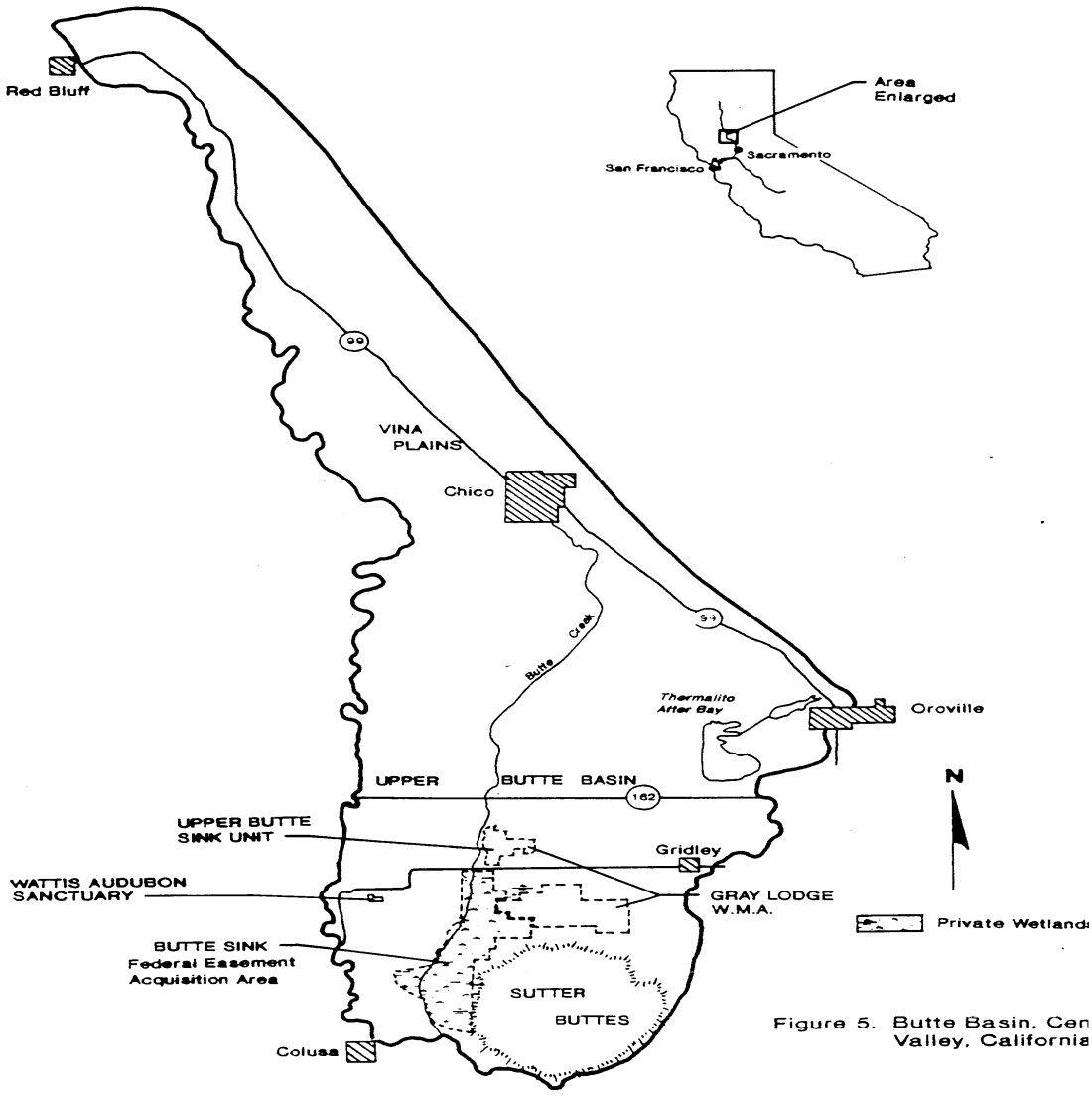


Figure 5. Butte Basin, Cen
Valley, California

The Butte Sink is located in the south portion of the basin. Land use in the Butte Sink has changed from its original condition. Federal and State water development projects have reduced flooding, and large areas have been converted to rice fields. The Butte Sink consists of a complex of natural and man-made levees, channels, and seasonally flooded bulrush marshes and woodlands. The land is low, with rise and swale topography typical of sluggish flood plains. The remainder of the south Butte Basin is mostly rice land.

Water used to flood wetlands in the Butte Basin is primarily from diverted rice-field surface drainwater in summer and fall and often from flood overflows of the Sacramento River and Butte Creek during winter. In addition, portions of the Sink receive water from the Feather River from mid-September to mid-February. The Sacramento River flood control system overflows into the Butte Sink, which often inundates 30-150 square miles during flood periods. The Gray Lodge WA and some private hunting clubs supplement drainwater with groundwater wells. Marsh management on Gray Lodge WA includes summer irrigations, prescribed burning, and mechanical control of vegetation to enhance habitat and produce waterfowl foods. Similar techniques also are used by some private clubs, including many that participate in the U.S. Department of Agriculture's (USDA) Water Bank Program.

Colusa Basin

The Colusa Basin extends from Red Bluff in the north to Cache Creek in the south, the Sacramento River on the east and the Coast Range on the west. The Basin contains over 1,600 square miles (110 miles long and about 15 miles wide). Most of the waterfowl habitat in the basin is south of the Stony Creek drainage (Figure 6).

The Colusa Basin is drained by a natural depression called the Colusa Trough. Historically, overflow from the Sacramento River joined with streams draining the east slopes of the Coast Range in the Colusa Trough and flooded the Colusa Basin marshes in winter and spring. The Trough drains the entire length of the Basin and re-enters the Sacramento River near Knight's Landing. Flood-control projects on the Sacramento River and the Colusa Basin Drainage Canal have eliminated severe flooding, except during extremely high precipitation years. Even so, about 26,000 acres of natural wetland habitat still remain in the Colusa Basin within a few miles of the Colusa Trough. The Trough is also the primary drain for an extensive system of rice fields, many of which are flooded and leased as private waterfowl hunting clubs in winter. Meteorological conditions are essentially the same as in the Butte Basin.

Three NWR's are in the Colusa Basin: Sacramento, Delevan and Colusa. These refuges consist of seasonal and permanent wetlands, moist-soil wetland impoundments, and croplands. Natural wetland habitat and associated uplands on the three NWR's total 20,450 acres. Water for these refuges is obtained on an intermittent-yield basis under a Bureau of Reclamation (BOR) agreement and delivered through irrigation districts.

There are more than 150 private duck hunting clubs in the Basin, covering about 25,000 acres--most of which is flooded rice. Most of the natural habitat is concentrated on the Willow Creek clubs east and north of Sacramento NWR (about 3,500 acres) and the Lurline Creek area between Delevan and Colusa NWR's (about 2,500 acres). The natural wetlands on these clubs are mostly seasonally flooded, although some practice more intensive marsh management, including participation in the Water Bank Program. Many of the private wetlands in the basin are protected by a USFWS Conservation Easement. Most water used to fill wetlands on the hunting clubs is agricultural surface-return flows, primarily from rice fields.

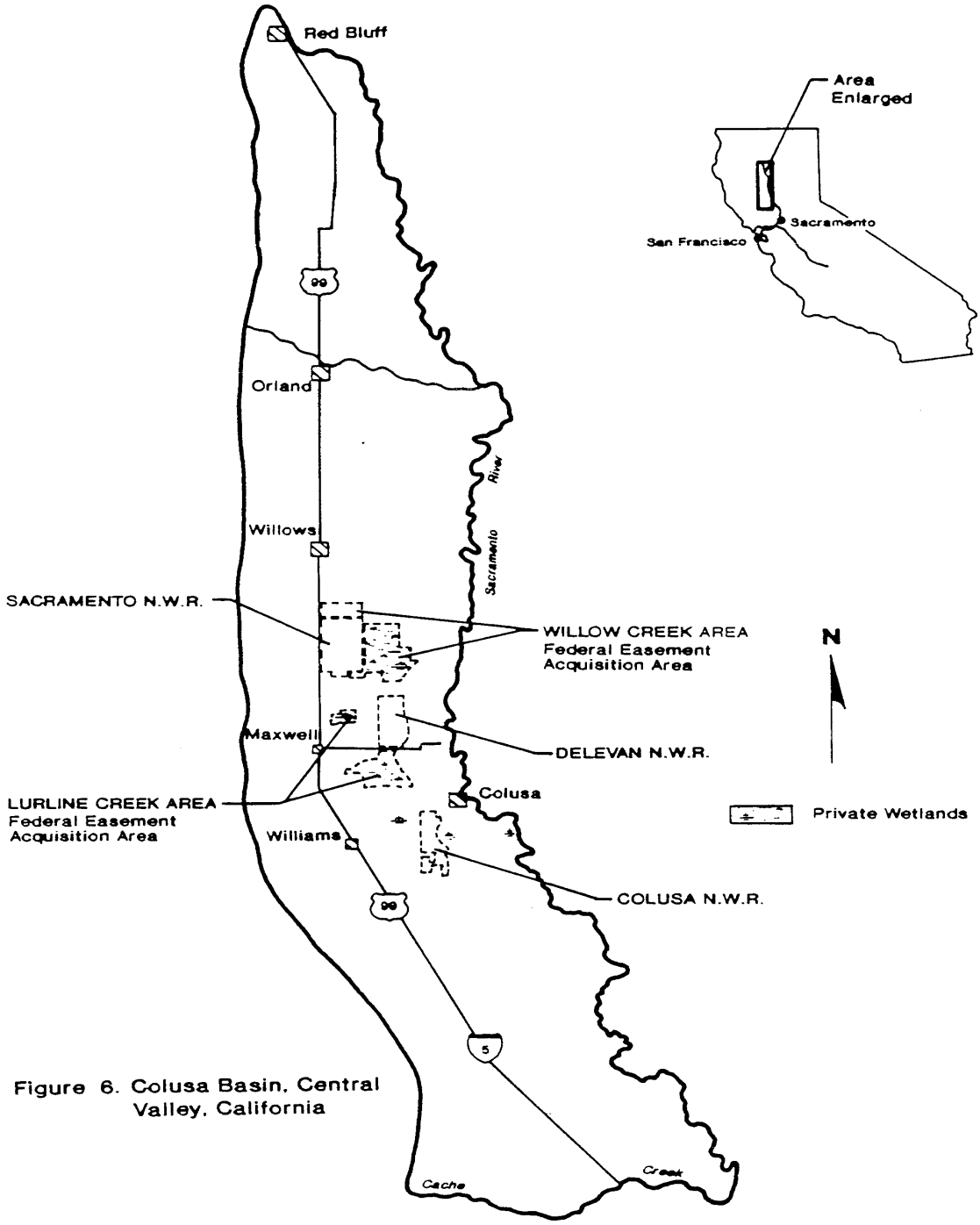


Figure 6. Colusa Basin, Central Valley, California

American Basin

The American Basin lies east of the Sacramento and Feather Rivers and west of the Sierra foothills between Oroville on the north and the American River on the south (Figure 7). The Basin contains about 600 square miles (60 miles long and about 10 miles wide). Historically, water from the American, Yuba, Feather, Sacramento, and Bear Rivers flooded the area. Construction of flood control reservoirs and levees now prevents most flooding in the American Basin.

There are no publicly owned wetlands in the American Basin. Hunting clubs maintain more than 12,000 acres of wetlands--about 3,200 acres of natural wetlands and 8,800 acres of flooded rice fields. Most of the hunting clubs and natural habitat are concentrated in the rice-farming area north of Marysville (District 10 Irrigation District). The Nicolaus-Lincoln-Wheatland and Natomas areas in the south end of the Basin provide some limited flooded rice habitat, and Camp Far West Reservoir is used as a loafing area by Canada geese.

Sutter Basin

The Sutter Basin extends south from the Sutter Buttes to the confluence of the Feather and Sacramento Rivers. The Basin lies between the Sacramento River on the west and the Feather River on the east (Figure 8). The Basin contains about 250 square miles (25 miles long and 10 miles wide).

Historically, overflow from the Sacramento River, the Butte Sink and the Feather River flooded 40,000-50,000 acres in the Sutter Basin in winter and spring. A large portion of the Basin was flooded year-round, providing a vast breeding and wintering area for waterfowl and other wildlife. Any water not retained in the Basin drained south into the Sacramento River.

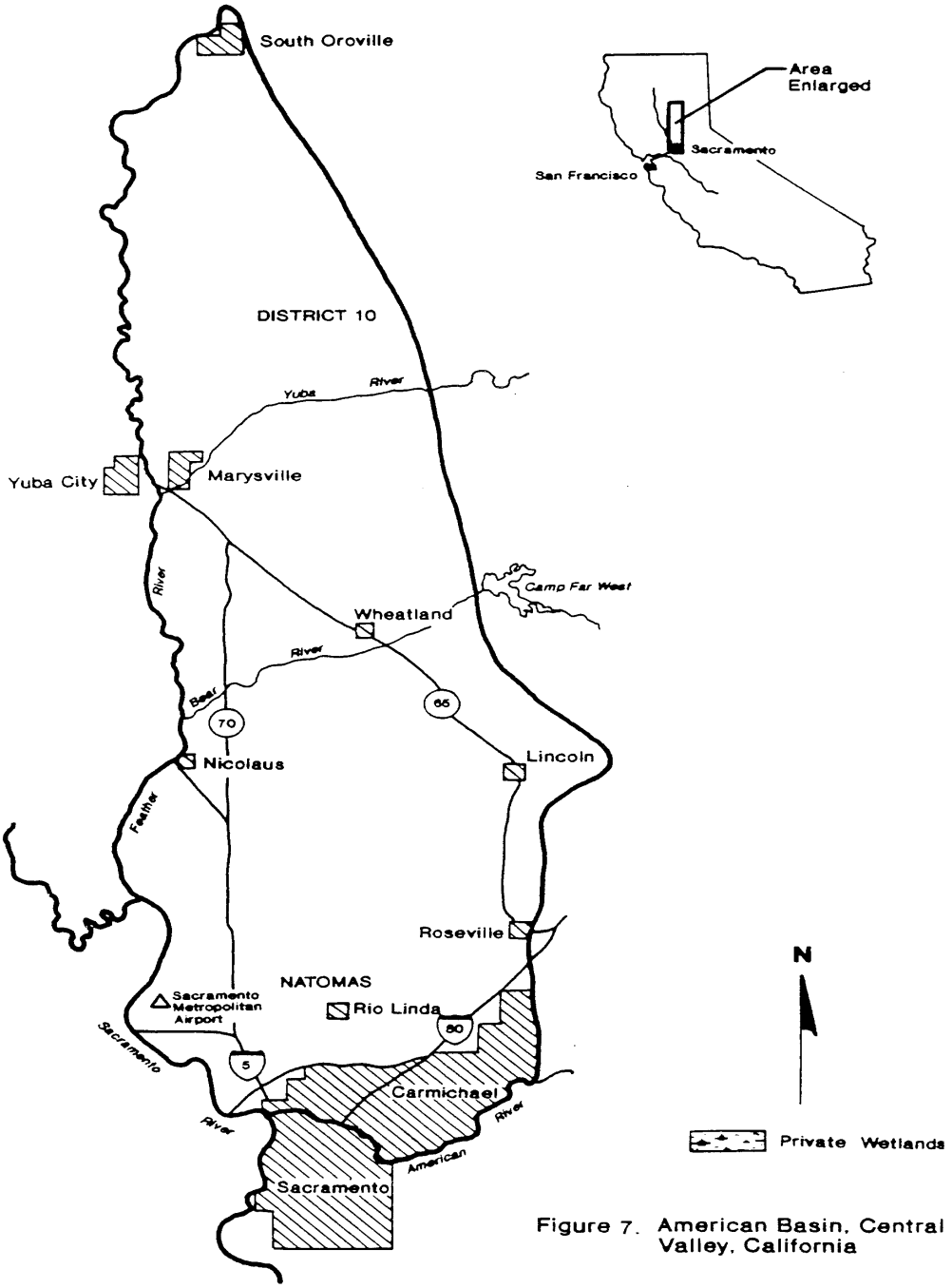


Figure 7. American Basin, Central Valley, California

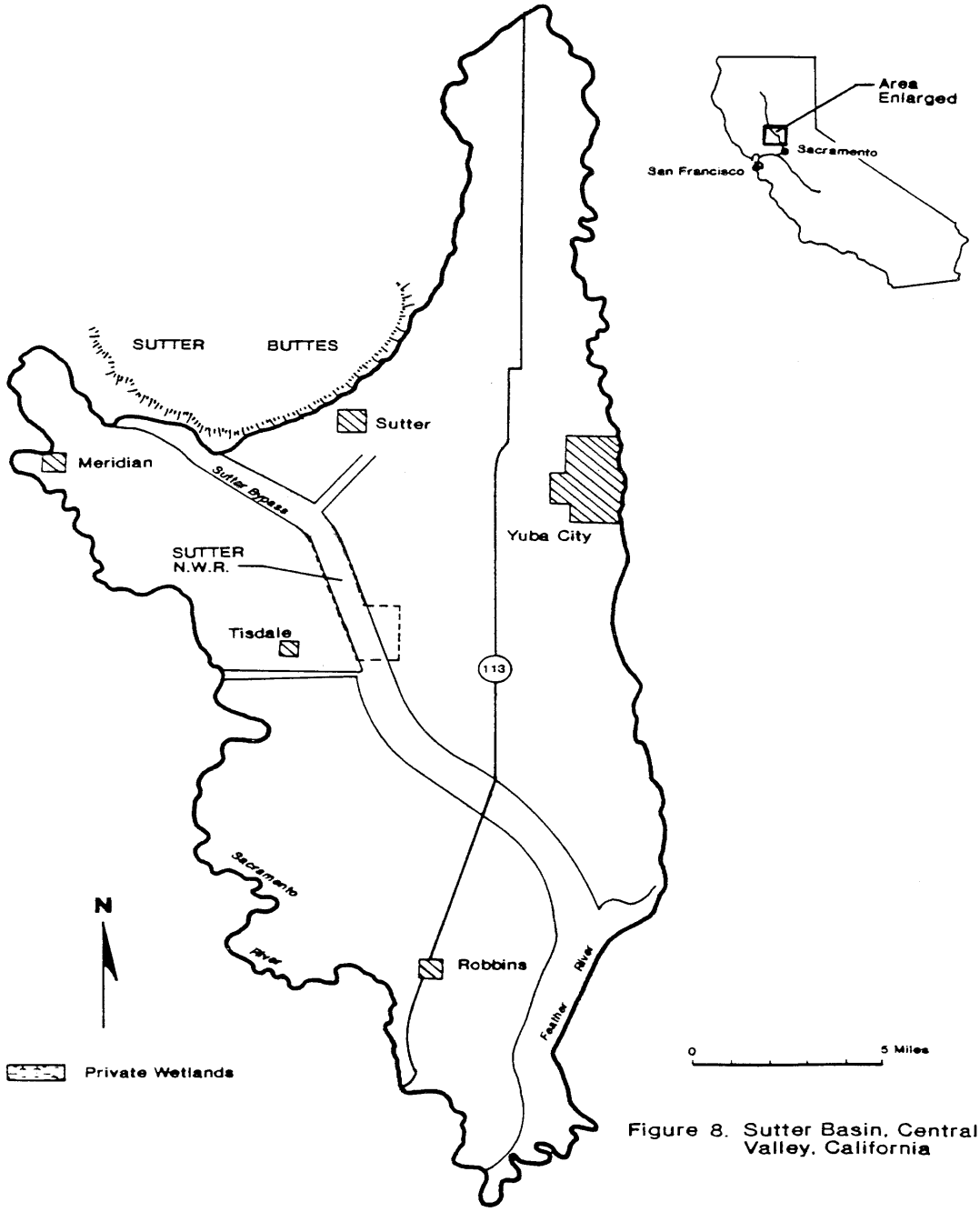


Figure 8. Sutter Basin, Central Valley, California

Construction of the Sutter Bypass and flood control systems on the Sacramento and Feather Rivers now prevents most flooding in the Sutter Basin. The Bypass provides significant waterfowl resting habitat when it floods during wet winters. Rice is the predominant agricultural crop in the Basin and provides an extensive food source for wintering waterfowl. Most of the private duck hunting clubs are rice lands that are flooded in late October or early November after the rice harvest. Agricultural drainwater is used to flood most wetland habitat and rice fields in the Basin.

Sutter NWR is the only publicly owned waterfowl habitat in the Sutter Basin. It consists of 2,590 acres of seasonally and permanently flooded marsh and scattered uplands. Private duck hunting clubs provide an additional 1,500 acres of habitat of which about 500 acres are natural wetlands. Most of the private duck hunting clubs and nearly all of the natural wetlands are located in the Sutter Bypass.

Yolo Basin

The Yolo Basin lies west of the Sacramento River between Cache Creek to the north and the Montezuma Hills and the Sacramento-San Joaquin River Delta to the south (Figure 9). The Basin contains about 400 square miles (40 miles long and 10 miles wide). Historically, the Yolo Basin received overflow water from the Sacramento and American Rivers and Cache Creek. A large part was under tidal influence. Yolo Basin marshes were permanent in the lowest, central part of the Basin. Marginal areas provided seasonal wetlands from winter and spring floods.

There are no publicly owned wetlands in the Yolo Basin. Hunting clubs maintain about 34,500 acres of habitat in the Basin, but not all of this area is flooded. Natural wetlands averaged 8,700 acres in 1976-85. This estimate may be high due to the 1976 drought.

Only small remnants of natural wetlands remain in the Basin. Most of them are seasonally flooded agricultural lands and pastures on private duck hunting clubs. Runoff and pumped groundwater are used to flood wetlands. During flood years, the Yolo Bypass provides a large resting area for waterfowl.

Sacramento-San Joaquin Delta

The Delta encompasses the mid-portion of the Central Valley between Sacramento south to the Stanislaus River. The eastern boundary is the Sierra Nevada foothills and the western boundary is the Yolo Basin, and the confluence of the Sacramento-San Joaquin Rivers (Figure 10). The Delta contains about 1,000 square miles (50 miles long and 20 miles wide). The Delta is characterized by numerous sloughs and channels formed where the Sacramento, San Joaquin, Cosumnes, Mokelumne and Calaveras Rivers enter the Delta. The waters from these rivers commingle in the Delta and are influenced by tidal action, stream flow, and water diversion as they flow into San Francisco Bay. Sixty former wetland islands in the Delta have been reclaimed by a network of levees, and the islands that they form are intensively farmed. The lower Sherman Island WA is the only publicly owned and managed wetland in the Delta. This WA comprises 3,100 acres of riparian and freshwater wetlands managed by the CDFG. TNC and DU jointly manage 1,500 acres of land at the Cosumnes River Preserve, 400 acres of which have been restored to wetlands.

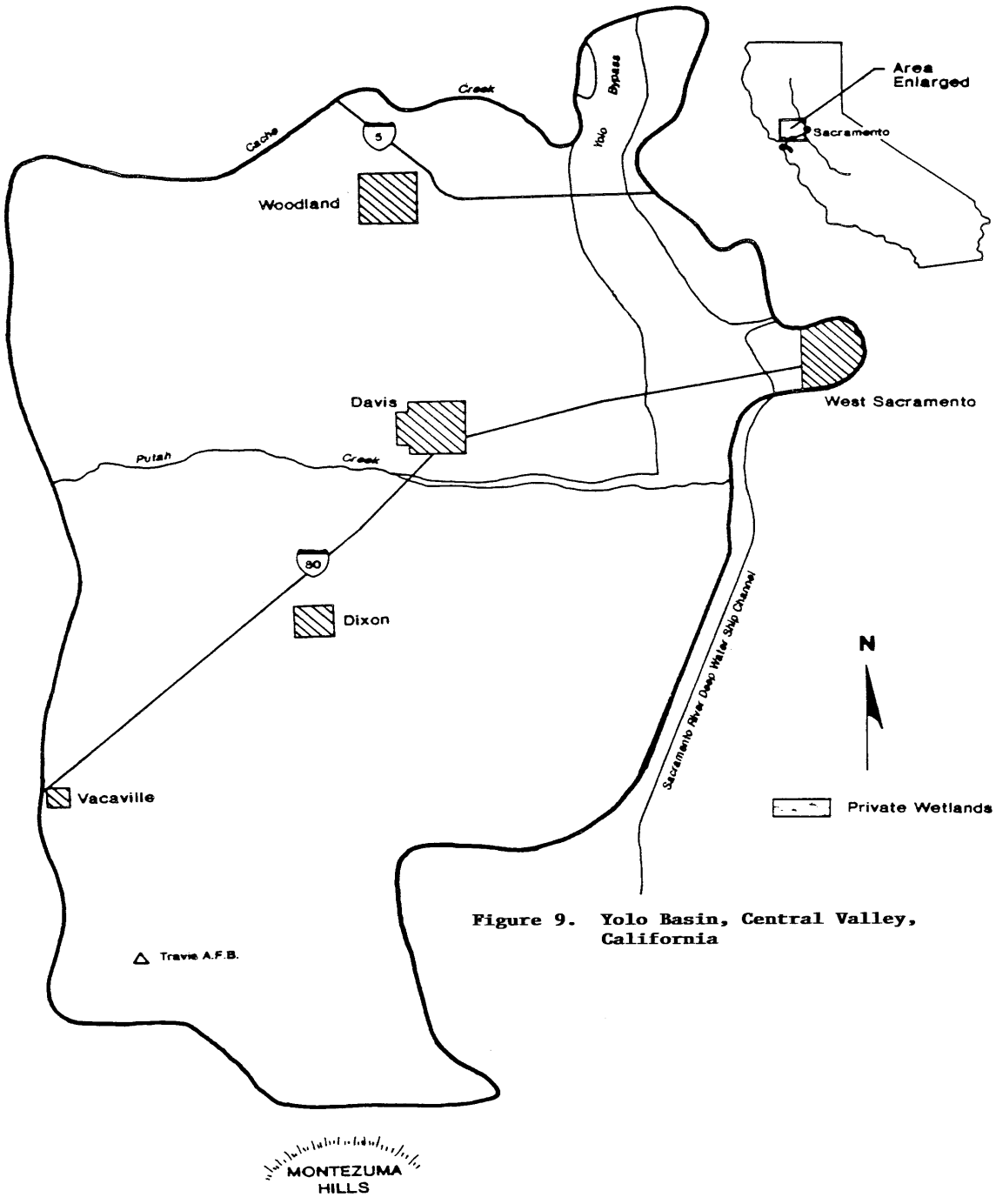


Figure 9. Yolo Basin, Central Valley, California

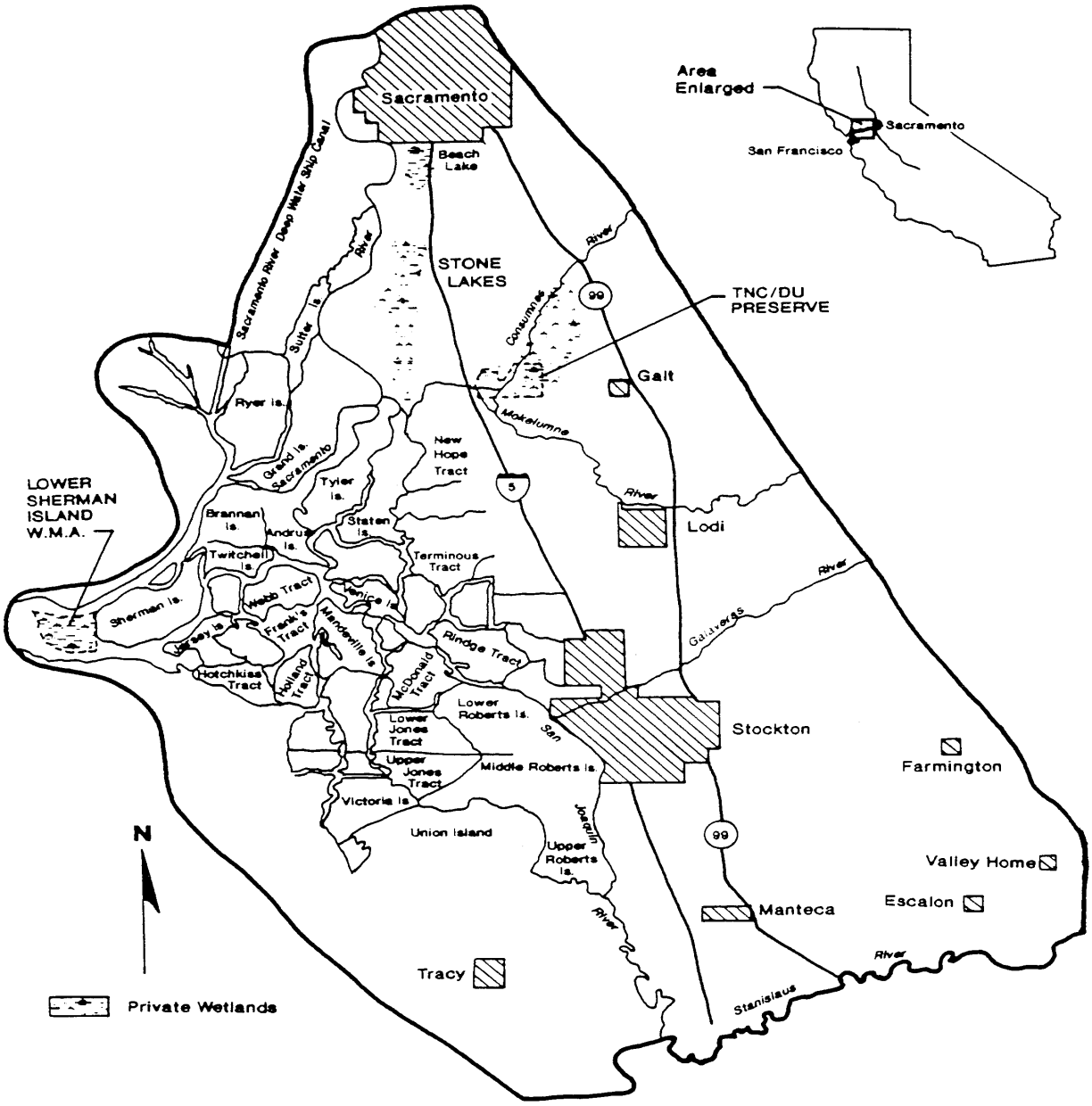


Figure 10. The Sacramento–San Joaquin River Delta, Central Valley, California

There are at least 84 private duck clubs in the San Joaquin drainage part of the Delta totaling more than 36,000

acres--12,000 acres of which are wetlands. Natural wetland habitat on private land is estimated at 3,400 acres. These estimates may be low because they were derived from National Wetland Inventory (NWI) mapping, which was conducted during drought conditions in 1976.

The Delta was historically one of California's most significant waterfowl areas. Reclamation and development (agricultural and industrial) have eliminated the marsh habitat from most of the region. Private duck hunting clubs consist primarily of flooded.(harvested) corn fields. This habitat is generally a by-product of late fall leach flooding, a process used to control soil salinity and undesirable weed species. Several islands in the Delta receive light hunting pressure and serve as sanctuaries to thousands of waterfowl. Waterfowl normally associated with the nearby Suisun Marsh move into the Delta in response to newly flooded habitat.

The Morrison Creek/Stone Lakes and Cosumnes River areas comprise the largest remaining complex of natural wetlands, lakes, and riparian areas of importance to waterfowl in the Delta. This area was originally an overflow area from the Sacramento and Cosumnes Rivers before levees were constructed to create and protect agricultural lands.

Major agricultural crops grown in the Delta are field corn, rice (southeastern portion of the basin), sorghum, alfalfa, pasture, and orchard fruits.

Suisun Marsh

The Suisun Marsh, south of Fairfield and Suisun City, is bounded in the south by the Sacramento River, on the east by the Montezuma Hills, and in the west by Interstate Hwy. 680 (Figure 11). The wetland covers about 120 square miles (12 miles by 10 miles) and is dominated by native wetland plants. Most of the wetland is contained by water-control levees and is at or below sea level. Water quality varies by season as a result of changes in freshwater outflow from the Sacramento and San Joaquin Rivers.

The Suisun Marsh is a brackish wetland located between the freshwater wetlands of the Central Valley and the saltwater marshes of San Francisco Bay. It has been modified over the years by natural erosion, upstream hydraulic mining, agricultural reclamation projects, channel improvements, and saltwater intrusion. Agricultural developments were limited because of poor drainage and high soil salinity.

There are about 12,000 acres of publicly owned wetland waterfowl habitat in the Suisun Marsh, including 10,900 acres managed by CDFG and 1,100 acres administered by the U.S. Navy. Private duck hunting clubs maintain an additional 45,710 acres of natural wetland habitat, and the bays and waterways provide another 27,000 acres of open water habitat. Although some habitat is flooded year-round, most of the clubs flood for the hunting season and for salinity control after the hunting season.

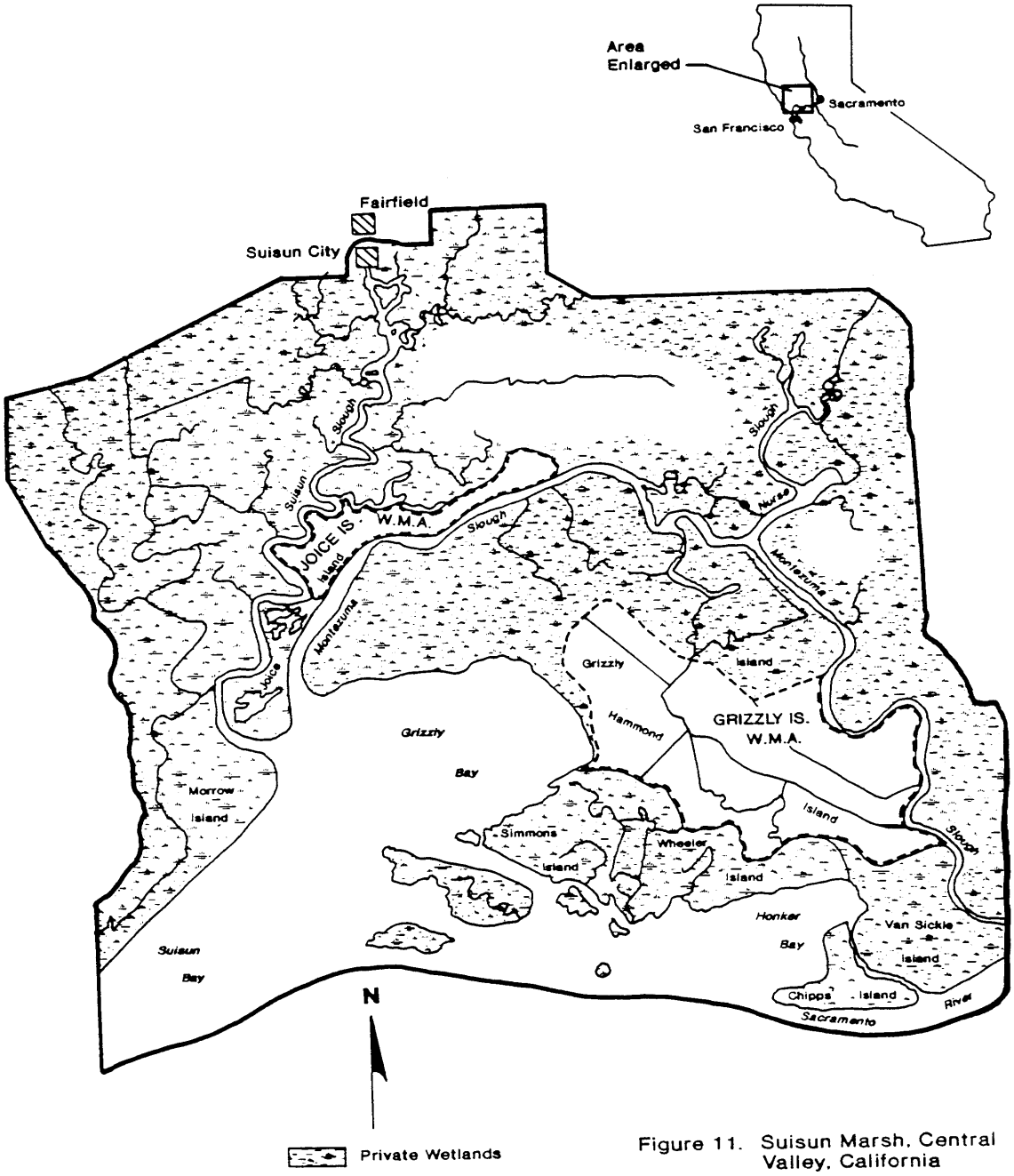


Figure 11. Suisun Marsh, Central Valley, California

San Joaquin Basin

The San Joaquin Basin is one of two large drainage basins that comprise the San Joaquin Valley. The Basin is about 85 miles long and 40 miles wide and covers 3,400 square miles. The northern boundary is the Delta (the Stanislaus River) and the southern boundary is the San Joaquin River (Figure 12). Historically, the San Joaquin Basin's major wetland areas were found east and west of the San Joaquin River, near Los Banos and Merced. Seasonal wetlands occurred from floods of the San Joaquin, Fresno, Chowchilla, Merced, Tuolumne, and Stanislaus Rivers.

Most water used for wildlife purposes is pumped from the Sacramento-San Joaquin Delta through the CVP and SWP, whereas most agricultural irrigation water is within-basin water. The major agricultural crops grown in the Basin include grapes, sugar beets, rice, alfalfa, cotton, fruits and nuts, melons, tomatoes, and beans. More-than 70% of the Basin is devoted to irrigated agriculture.

There are 25,167 acres of publicly owned and managed natural waterfowl habitat on six areas in the San Joaquin Basin. These areas are Kesterson (5,900 acres), San Luis (7,340 acres), San Joaquin River (780 acres), and Merced (2,561 acres), NWR's and the Los Banos (5,586 acres) and Volta (3,000 acres) State WA's.

Private wetlands are located mostly in the West and East Grasslands areas. Within the West Grasslands, there are 164 private hunting clubs (65,000 acres) including 6,400 acres of permanent marsh, 31,000 acres of seasonal marsh and 27,600 acres of upland. Many clubs in the West Grasslands are permanently protected by USFWS Conservation Easements. The East Grasslands includes 50 parcels totaling 36,500 acres, of which 29,000 acres are uplands and 7,500 acres are wetlands.

Most of the West Grasslands is included in the Grassland Resource Conservation District (GRCD). The GRCD maintains existing wetlands for waterfowl hunting and cattle grazing. Enhancement of these wetlands by production of moist-soil food plants is encouraged. No flooded agricultural fields are present in this area. Water is presently obtained from the CVP, pumped groundwater, and irrigation drainwater.

The East Grasslands includes large expanses of native uplands and wetlands. Major land uses are cattle ranching, rice and row crop farming, and private duck hunting clubs. Most wetlands are seasonally flooded from winter rainfall and runoff. Some permanent wetlands are present where irrigation runoff and seepage from adjacent creeks and major water conveyance canals is adequate. Water used to flood wetlands is obtained from the Merced Irrigation District, wells, creek diversions, and agricultural surface runoff.

The Faith and Mapes Ranches, about 10 miles west of Modesto, contain about 10,000 acres of irrigated pasture and 500 acres of seasonal wetlands. About 3,000 acres of private wetlands occur in scattered blocks throughout other areas in the Basin. Congress has approved the establishment of the 10,300 acre San Joaquin River NWR near the Faith and Mapes Ranches. To date, 780 acres of seasonal wetland and riparian habitat have been acquired. The area is critical habitat for wintering Aleutian Canada geese, an endangered species.

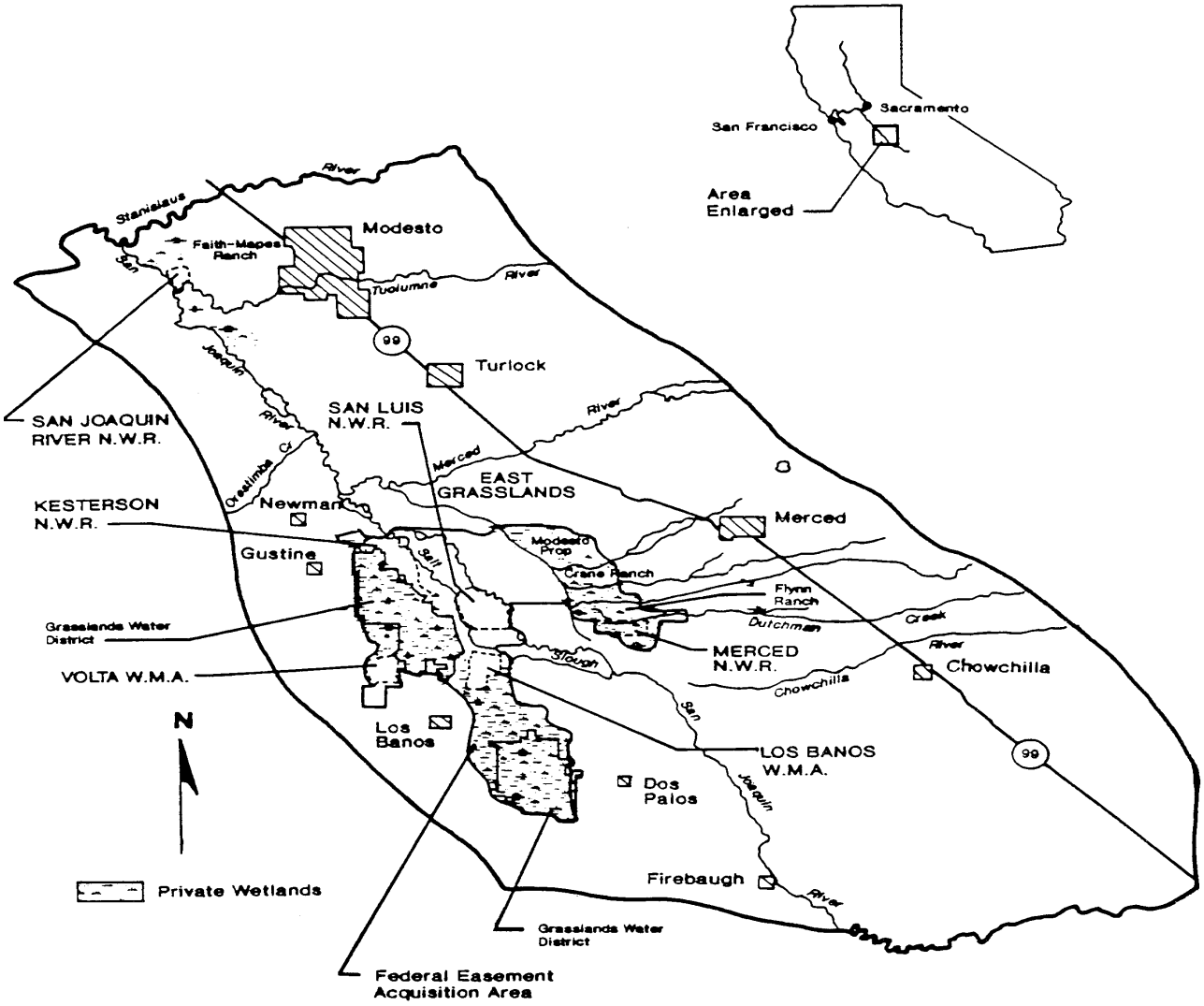


Figure 12. San Joaquin Basin, Central Valley, California

Tulare Basin

The Tulare Basin is the southernmost basin in the Central Valley (Figure 13). The basin is bounded on the south, east, and west by the foothills of the Tehachapi, Sierra Nevada, and Coast Range mountains, respectively. The northern boundary of the Basin is formed by the San Joaquin River. The Basin contains about 5,700 square miles (135 miles long and 30 to 50 miles wide).

Despite being the driest region of the Central Valley, the Tulare Basin was the largest single block of wetland habitat historically present in California, providing about 260,000 acres of permanent wetland and an additional 260,000 acres of seasonally flooded scrubland. During most years, the Basin functioned as a sink. Water from the Sierra Nevada flowed down a number of streams including the Kern, Kings, and Tule Rivers, into a series of shallow lake basins within the sink. These lakes (Tulare, Kern, Goose, and Buena Vista) , provided habitat for millions of migrant waterfowl and shorebirds. During exceptionally wet years, water flowed north from these lakes into the San Joaquin River.

Diversion of water for agricultural and municipal uses ultimately resulted in the drainage and agricultural reclamation of these lakebeds. Now the lakebeds remain dry during all but the wettest years. Wetland acreage remaining in the basin during normal and dry years provides less than one percent of the habitat that once existed. The Mendota WA, Kern-Pixley NWR Complex, and a few private duck clubs provide some natural habitat, but more than half the remaining wetland acreage falls into the categories of drainwater evaporation ponds, sewage ponds, and areas created by agricultural pre-irrigation.

Agriculture is the primary industry in the Basin. Major crops include barley, grapes, sugar beets, and cotton. Ninety-eight percent of the crops are irrigated.

Publicly owned waterfowl areas in the Tulare Basin encompass 28,715 acres and include two NWR's and one WA. Much of Kern (10,618 acres) and Paisley (5,992 acres) NCR's are dry, however, because sufficient funds to purchase full water supplies are presently unavailable. In recent years, 2,000 to 2,500 acres of wetlands on Kern NWR have been flooded. Pixley NWR is nearly dry most years. The Mendota WA covers 12,105 acres and is the largest publicly owned and managed wetland in the San Joaquin Valley. It is intensively managed and is nearly all wetland with some associated uplands.

Private duck hunting clubs in the Tulare Basin provide 3,260 acres of seasonal wetlands. Six clubs are in the Mendota WA area, 5 in the Kings Tulare area, 35 near Kern NWR, and 3 in the Greenfield area (Buena Vista-Kern Lake). Virtually no permanent water exists in the Basin.

Agricultural pre-irrigation, the practice of saturating the soil before planting, provides an annually variable but declining acreage of flooded croplands. Pre-irrigated fields, particularly barley, wheat, and safflower, are used heavily by ducks in fall and winter, and are especially favored by northern pintails. Water conservation efforts and changing agricultural practices in recent years have greatly reduced the amount of pre-irrigated lands.

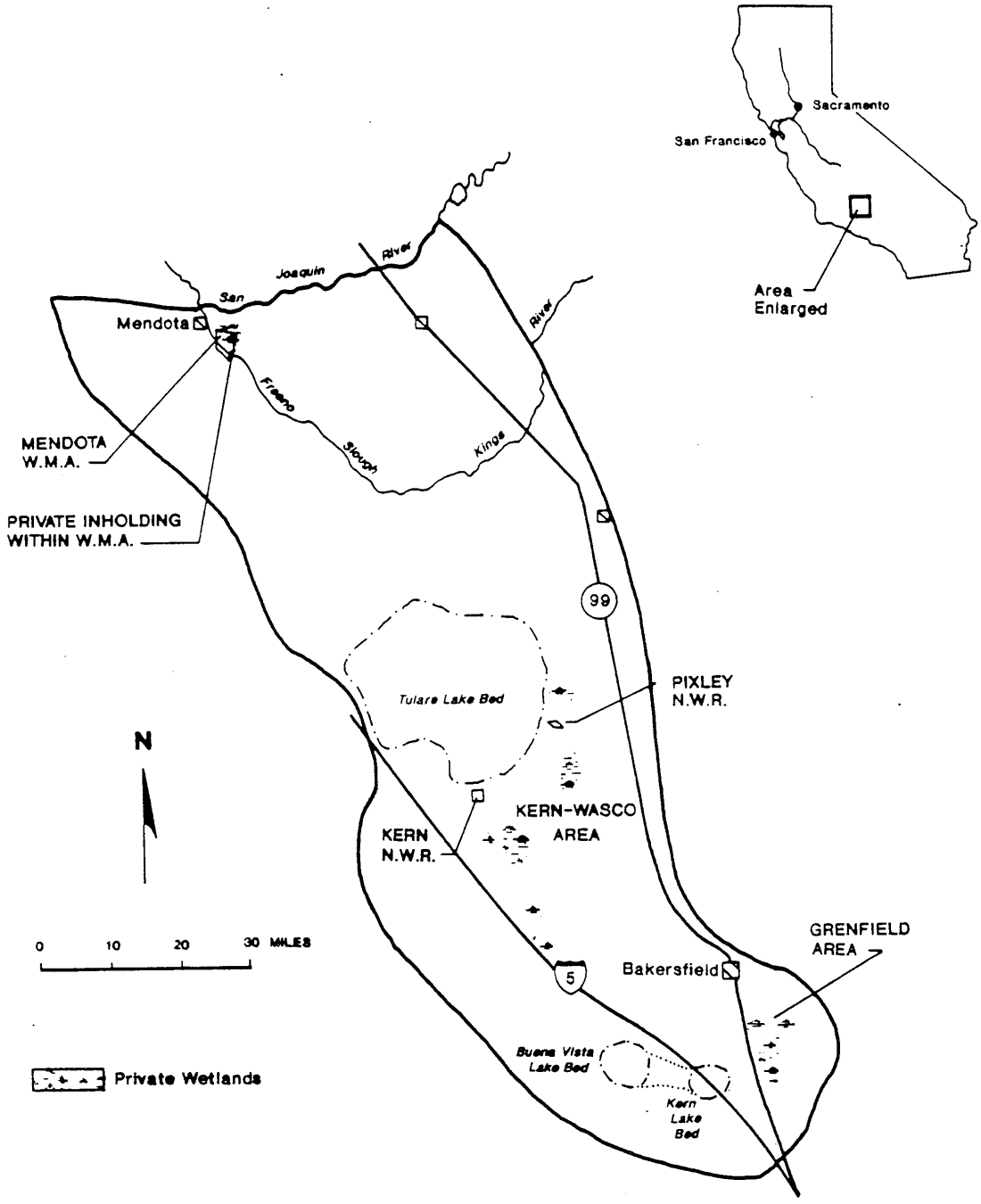


Figure 13. Northern Tulare Basin, Central Valley, California.

BIOLOGICAL BASIS FOR OBJECTIVES

Population Objectives

The objective waterfowl populations for the Central Valley include an average peak population of 4.7 million ducks and 865,000 geese and swans (Table 1). Pintails have historically comprised more than 60% of all ducks wintering in the Central Valley. Consequently, an average winter population peak of 2.8 million pintails is desired. Although the NAWMP targets an average number, it is recognized that peak numbers in a given year may be slightly more or less than objective levels because of population fluctuations. The Central Valley wintered 24.7% of all ducks counted in the United States in midwinter, 1970-79. Unfortunately, estimates of peak winter numbers of ducks are known to underestimate continental and regional populations and do not accurately reflect the spring flight to breeding areas. It is likely that a higher proportion of ducks present in the Central Valley are counted than in other locations (e.g., lowland hardwood wetlands) because visibility is good in open marshes and birds are concentrated in limited wetland areas. Ducks are not sedentary during winter, however, and movements within and between regions are common winter strategies for meeting nutritional, social, and physiological needs. As such, a much larger number of ducks "flow through" the Central Valley than are present at any one time and it is possible that 10-12 million ducks may spend at least part of the winter in California. For this reason, the exact contribution of the Central Valley in supporting winter populations that enter the spring flight to breeding areas is unknown, but may be as high as 20% of all ducks, and more than 60% of the objective level of breeding pintails.

Desired breeding populations in the Central Valley include 490,000 total ducks and 300,000 mallards. If these breeding populations are achieved, the Central Valley could generate a fall population of more than 1 million total ducks. Annual use-days of desired waterfowl populations in the Central Valley will be 112.5 million for geese and 750 million for ducks, if use-days are calculated as a linear function of a gradual buildup in fall to desired peak winter populations, followed by a gradual decline to desired summer breeding levels (Figure 14).

Species Considerations

Key species in the Central Valley include mallards, northern pintails, American wigeon, green-winged teal, cinnamon teal, northern shiverers, gadwalls, wood ducks, ruddy ducks, Pacific white-fronted geese, tule white--fronted geese, lesser snow geese, Ross' geese, cackling Canada geese, Aleutian Canada geese, and tundra swans. The Aleutian Canada goose is endangered, and continental populations of northern pintails, Pacific white-fronted geese, and cackling Canada geese are extremely low compared with levels present in the early 19701's.

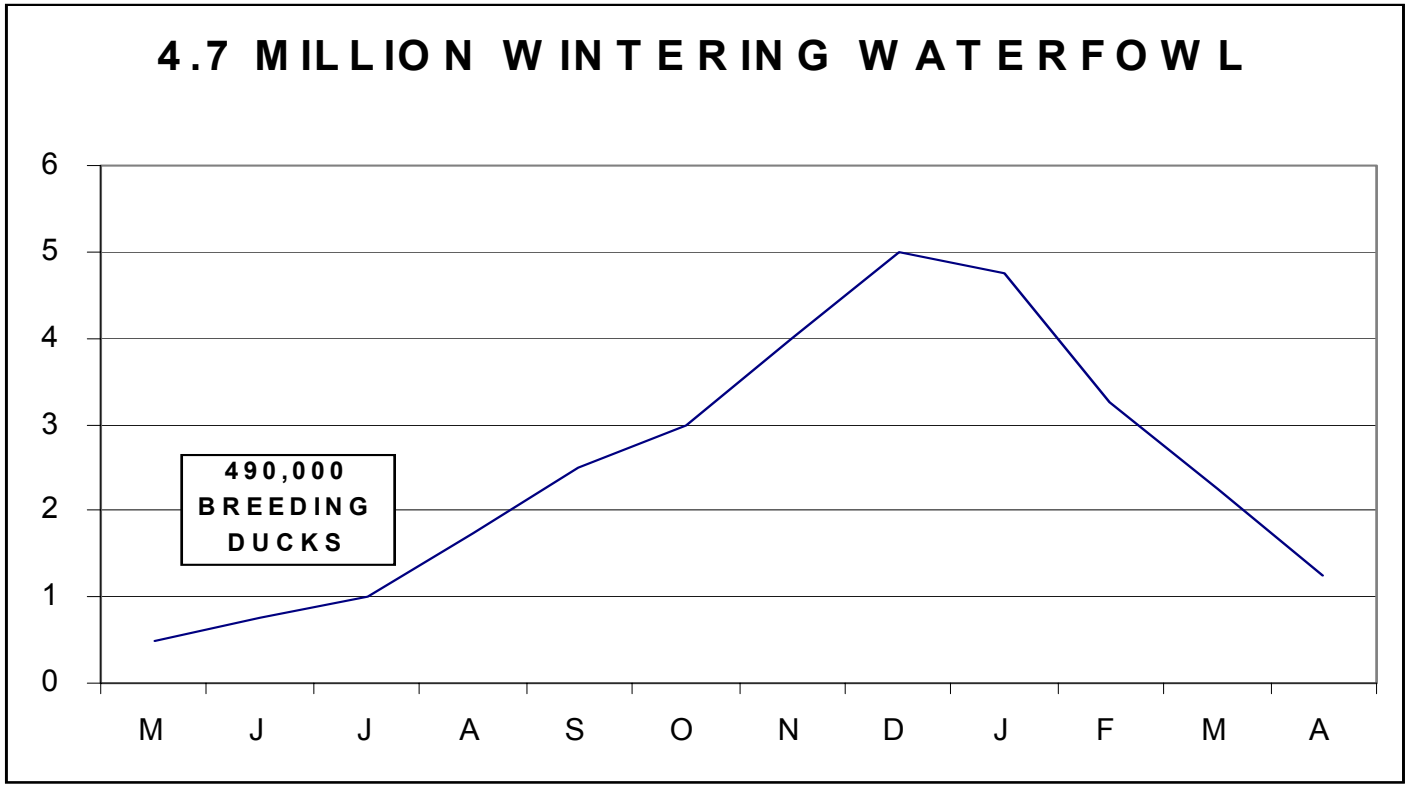
Table 1. Waterfowl population (X 1,000) objectives of the Central Valley Habitat Joint Venture relative to those of the North American Waterfowl Management Plan.

Annual Period and Species	Central Valley	North America	Central Valley as % of total
Breeding			
Total Ducks	400	62,000	0.8
Mallard	300	8,700	3.4
Winter (peak)			
Total ducks	4,700	[a]	[a]
Mallard	531	[a]	[a]
Pintail	2,800	[a]	[a]
Total geese and swans [b]	875	5,701	15.3
Cackling Canada	200	250	80.0
Aleutian Canada	5	5	100.0
Lesser Snow	320	1,760	18.2
Ross'	100	125	80.2
Tule White-fronted	5	5	100.0
Pacific White-fronted	200	300	66.7
Tundra Swan	40	60	66.7

[a] No winter goals have been established in the NAWMP for ducks.

[b] Reflects recent winter distribution patterns and adjusted for 25 percent annual recruitment.

Figure 14. Seasonal chronology of waterfowl use in the Central Valley of California.



In California, most mallards, Tule white-fronted geese, lesser snow geese, wood ducks, and American wigeon winter in the Sacramento Valley; while most Northern shovelers, green-winged teal, and gadwalls winter in the San Joaquin Valley. Many Ross', cackling Canada, Aleutian Canada, and white-fronted geese, along with tundra swans, traditionally begin the winter in the Sacramento Valley but move to the Sacramento-San Joaquin River Delta and San Joaquin Valley by late winter. Pintails are highly mobile and use the entire Central Valley extensively throughout the winter. Areas especially important for pintails include wetlands and flooded agricultural lands in Butte, Colusa, and San Joaquin basins, and the Suisun Marsh.

Waterfowl species have different food, habitat, and social preferences and requirements. Knowledge of these differences is important to help guide site-specific acquisition and management (enhancement) approaches in various basins covered by the CVHJV. For example, a primary goal of wetland restoration activities in the Butte Basin may be to restore floodplain and riparian wetlands critically needed by wintering mallards, wood ducks, and Tule white-fronted geese. In contrast, wetland enhancement in the San Joaquin Valley may seek to encourage seasonal wetlands dominated by short annual vegetation, highly desired by pintails. Certain specific management approaches are further addressed in the wetland enhancement chapter.

Energetic Requirements

A key component of the habitat programs needed to support the objective levels of waterfowl in the Central Valley is assuring that the energetic requirements of the birds are met. The energy requirements of the projected waterfowl populations in the Central Valley were calculated in order to estimate food requirements, and thus the wetland and agricultural land needed to provide this food.[1] When these equations were solved using the desired use-days of all waterfowl species, it was determined that approximately 351.8 million pounds of food are required to support annual waterfowl populations in the Central Valley at objective levels.

The area of wetlands and agricultural lands needed to provide this food was calculated by using certain broad assumptions about how much food is available to, and consumed by, waterfowl in each habitat type. Harvested rice and corn fields are the primary agricultural lands used by wintering waterfowl in the Central Valley and thus offer the greatest potential for enhancement that would directly benefit wintering waterfowl. Approximately 250 pounds per acre of waste grain, weed seeds, and invertebrates are potentially available and consumed by waterfowl in harvested rice fields. Wetlands provide more food per acre than harvested grain fields, and well managed marshes may produce more than 2,000 pounds of combined seeds, tubers, green forage, and invertebrates per acre.[1] Production of these foods in wetlands is extremely variable depending on vegetation present, the length of time since disturbance of vegetation and soils, and management strategies. Private duck hunting clubs comprise more than 70 percent of all wetlands in the Central Valley and they typically manage for a combination of moist-soil foods. Production of a complex of these foods in well-managed wetlands probably averages more than 1,500 pounds per acre, and if it is assumed that waterfowl consume an average of 50 percent of foods available (averaged over all wetlands), then 750 pounds per acre potentially consumed by waterfowl in wetlands can be used for calculations.

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[1] Heitmeyer, M.E., 1989. Agricultural - Wildlife Enhancement in California: The Central Valley Habitat Joint Venture. Trans. N. Am. Wildl. Nat. Resour. Conf. 54 (in press).

The preceding discussion and assumptions helped guide the development of implementation strategies for wetland and agricultural land enhancement objectives. For example, enhancing water availability and control will help managers maximize food production on public and private wetlands, and deferring fall tillage on agricultural lands will increase the availability of waste grains and invertebrates to waterfowl.

The wetland restoration objective seeks to increase wetland area in the Central Valley by 120,000 acres. This goal was based on realistic expectations of the potential for conversion of agricultural lands into wetlands in the Central Valley. If this goal is achieved, 412,000 acres of wetlands will be present (Table 2). If wetlands provide an average of 750 pounds of food per acre to waterfowl, then 78% of the energy requirements of objective waterfowl populations in the Central Valley will be met by wetlands. Food supplies to meet the remaining energy deficit could be provided by 332,300 acres of managed, harvested grain fields (providing an average of 250 pounds per acre consumed by waterfowl). The agricultural enhancement objective addresses how enhancement of this amount of agricultural lands will occur.

Nesting Habitat

The amount of upland nesting cover needed to support the desired breeding population of 490,000 ducks in the Central Valley is unknown. Factors contributing to use and nesting density include the species of duck and its distribution, vegetation type and density, proximity to wetlands, and relative disturbance by predators. In the Central Valley, waterfowl nest primarily in wheat fields, hay and pasture lands, and scattered, idle vegetated lands such as set-aside lands. Little upland area presently exists that is managed specifically for nesting waterfowl. Opportunities to enhance nesting habitat over large areas are greatest on set-aside lands and pastures because of the commercial harvest constraints on wheat and hay lands, and the relatively small area of managed uplands in public wildlife management areas. Given the above considerations, the agricultural enhancement objective was established to enhance 110,800 acres of set-aside lands for waterfowl nesting.

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[1] Fredrickson, L.H., and T.S. Taylor, 1982. Management of seasonally flooded impoundments for wildlife. U.S. Dept. Interior, Fish and Wildl. Serv. Resour. Publ. 148. 29 pp.

Table 2. Estimated acreage (hectares in parentheses) of agricultural lands needed to meet energy needs of waterfowl in the nine drainage basins of the Central Valley of California.

Basin	Percentage Distribution Waterfowl-	Current Wetland Acreage (X 1,000)	Proposed Wetland Acreage (x 1,000) [1]	Supplemental Agricultural Acreage Needed (X 1,000) [2]
Butte	23	26 (10.5)	60 (24.3)	128.7 (52.1)
Sutter	7	3 (1.2)	14 (5.7)	48.9 (19.8)
American	5	3 (1.2)	13 (5.3)	25.1 (10.2)
Colusa	15	26 (10.5)	41 (16.6)	75.3 (30.5)
Yolo	5	9 (3.6)	19 (7.7)	10.1 (4.1)
Suisun	5	58 (23.5)	58 (23.5)	- -
Delta	10	10 (4.0)	30 (12.1)	44.2 (17.9)
San Joaquin	25	121 (49.0)	141 (57.1)	- -
Tulare	5	36 (14.6)	36 (14.6)	- -
Total	100	292 (118.1)	412 (166.9)	332.3 (134.6)

[1] As determined by the Wetland Restoration Workgroup of the Central Valley Habitat Joint Venture.

[2] Includes rice, corn, milo, and barley croplands used by waterfowl, but does not include set-aside, wheat, or other croplands.

HABITAT PROTECTION OBJECTIVE

Statement of Objective

Protect 80,000 additional acres of existing privately owned wetlands through acquisition of fee-title or perpetual conservation easements. All acquisitions will be contingent upon a firm supply of good quality water.

This objective has been organized and prioritized by basin (Table 3). These objectives were adopted from the 1987 update of the U.S. Fish and Wildlife Service's Central Valley Concept Plan as a result of improved data from more recent wetland mapping and field surveys. The overall acquisition objective represents 67 percent of the existing unprotected wetlands in the Central Valley. While it would be desirable to protect all existing habitat, it is not practical because many owners are unwilling sellers. Therefore, 80,000 acres was chosen as an objective that was feasible, challenging, and large enough to make a significant difference to the waterfowl of the Central Valley.

Background

Past Efforts and Activities

A total of 291,555 acres of wetlands important to waterfowl were present in the Central Valley in 1989 (Table 4). This total includes some uplands and vernal wetlands that comprise part of the wetland complexes protected and that are also important waterfowl habitat. In contrast, this total does not include smaller wetlands and riparian areas that have little current use or potential for use by waterfowl. Data were compiled from the most recent NWI wetland surveys available, with refinements by field observations where possible. Wetland surveys in some basins were conducted during drought conditions in 1976; consequently, these estimates may be low. About 59 percent (172,655 acres) of the wetlands remaining in the Central Valley have been permanently protected through acquisition by fee-title or perpetual conservation easement by government agencies and private conservation groups or by legislative actions.

Justification

Of an estimated 4 million acres of wetlands present in the Central Valley of California in the mid-1800's, more than 95 percent have been destroyed or converted to other land use. Most wetland losses resulted from reclamation and water development projects related to agricultural development. The importance of preserving all existing wetlands in the Central Valley to help meet the needs of wintering waterfowl was expressed in the USFWS 1978 Concept Plan for Waterfowl Habitat Preservation for California's Central Valley, which states, "Nowhere in the United States are so many waterfowl dependent on so few acres of wetlands." The continued loss of wetlands must be curtailed if population objectives of the NAWMP are to be achieved.

Table 3. Habitat acquisition objectives (in acres) for the Central Valley Habitat Joint Venture, North American Waterfowl Management Plan.

Basin [1]	Unprotected Wetlands	Concept Plan Objectives	CVHJV Objectives
Yolo	8,700	2,000	5,000
American	3,150	2,000	2,000
San Joaquin	67,000	49,500	52,500
Tulare	19,560 [2]	5,000	5,000
Butte	12,200	10,000	10,000
Delta	4,300	6,000	3,000
Colusa	3,400	5,000	2,000
Sutter	500	500	500
Total	118,810	80,000	80,000

[1] Basins are listed here in order of priority. Priorities were established using the percent of unprotected habitat (Table 4) as the ranking factor. A higher percent of unprotected habitat equates to higher priority. In cases where basins had equal portions of unprotected habitat, higher priority was given to the basin with the most wetland acres.

[2] Includes 5,600 acres in the Wilbur flood area and 8,600 acres in the Hacienda Ranch flood area. Only in winters of extremely high precipitation do these areas totally flood. In average precipitation years, less than 2,000 acres are flooded.

Table 4. Status of existing wetlands (in acres) in the California Central Valley, 1989.

	Protected [1]						
Basin	**Federal Fee**	**State Fee**	**Federal Easement**	**Private**	**Total**	**Unprotected [2]**	**% Total**
Yolo	-	-	-	-	0	8,700 (100)	8,700
American	-	-	-	-	0	3,150 (100)	3,150
San Joaquin	16,580	8,590	28,130	-	53,300	67,000 (55)	120,300
Tulare	2,300	12,105	-	2,325 [3]	16,730	19,650 (54)	36,380
Butte	-	8,600	5,350	-	13,950	12,200 (46)	26,150
Delta	-	3,500	-	1,550 [4]	5,050	4,300 (45)	9,350
Colusa	20,450	-	2,585	-	23,035	3,400 (13)	26,435
Sutter	2,590	-	-	-	2,590	500 (13)	3,090
Suisun	1,100	10,900	-	46,000	58,000 [5]	0 (0)	58,000
	43,020	**43,695**	**36,065**	**49,875**	**172,655**	**118,900**	**291,555**

[1] "Protected" is defined as those wetlands owned in fee by a public (Federal, State, County) agency, or privately owned wetlands that have a perpetual conservation easement.

[2] "Unprotected" is defined as any privately owned wetland not covered by a perpetual conservation easement.

[3] Includes 1,425 acres owned by Kern County (Lake Woolomes Park, 425 acres; Buena Vista Recreation Area, 960 acres).

[4] The Cosumnes Preserve owned by The Nature Conservancy.

[5] The entire 58,000-acre Suisun Marsh was protected by the Suisun Marsh Protection Act of 1977.

Threats to Existing Wetlands:

Major threats to existing wetlands in the Central Valley include:

Conversion to Agriculture - The economic pressure to convert privately owned wetlands to croplands remains strong throughout the Central Valley, despite a depressed agricultural economy for certain grain crops in recent years.

Conversion to Residential or Industrial Uses - This is especially true in the San Joaquin Basin and the Delta where population growth from the San Francisco Bay and Sacramento areas is creating pressure on all undeveloped land for urban expansion.

Water Quality - Much of the water available to both publically owned and unprotected private wetlands is agricultural drainwater that is often of poor quality because of contamination by pesticides or concentrations of toxic substances. When water quality becomes a serious threat to waterfowl, it can result in the abandonment or conversion of wetland habitat. This threat is the most serious in the Tulare and San Joaquin Basins.

Water Quantity - Many private wetland owners and most public wetland areas do not have adequate contracts or rights for water to maintain or manage their wetlands. The problem can be water quantity, reliability, or timing. This has caused abandonment or conversion of wetlands, especially in the Tulare Basin, where there has been a 50 percent decline in duck clubs in the past 15 years. Easement programs are feasible only if firm and affordable water supplies are available to the clubs. All acquisitions should be contingent on a secure water supply.

Operational Cost - As the cost of water and electrical power increase, many private clubs and public management areas cannot afford to continue operation. Thus, valuable wintering habitat is lost. This problem is most severe in the San Joaquin Valley, where delivered surface water is more expensive than the Sacramento Valley and deep water wells make pumping costs prohibitive.

Strategies to Accomplish Objective

Existing Programs

Preservation of remaining important natural wetland habitat in the Central Valley could be accomplished through existing habitat preservation programs of the USFWS, CDFG, TNC, NAS, TPL, and others. In most basins, a feasible course of action would be for the USFWS to acquire conservation easements on much of the habitat by continuing acquisition within existing easement projects, expanding these projects, or starting new projects.

Administratively, it would be desirable for the USFWS to develop one (Central Valley), or two (San Joaquin Valley and Sacramento Valley), large easement projects to cover all of the habitat proposed for easements

throughout the Central Valley. It also would be desirable for the CDFG to develop a conservation easement program. This State program would complement the USFWS easement program and provide a mechanism for protection where Federal acquisition would not be feasible.

In many areas, continued fee-title acquisition of lands by the USFWS and CDFG is desirable, especially for lands adjacent to an existing or approved management area or where no State or Federal areas exist.

A proposed cost and time schedule for the habitat preservation objective is shown in Table 5. The criteria used to establish priorities for protection of habitat within each basin follow:

Priority 1 - Wetlands with traditionally high waterfowl use.

Priority 2 - Wetlands with low to moderate use by waterfowl but adjacent to lands potentially restorable to wetlands (as identified in wetland restoration narrative).

Priority 3 - Wetlands with low to moderate use by waterfowl and not adjacent to lands potentially restorable to wetlands.

Priorities between basins were determined by using the percent of unprotected habitat as the ranking criteria (see footnote 1, Table 3, page 42).

New Programs

A possible new program would be for the USFWS or CDFG to acquire identified habitat by exchange between the landowner and the U.S. Bureau of Land Management (BLM). The potential for this program is being explored with the BLM.

Administration and Coordination

A land acquisition coordination committee has been formed by the agencies and groups participating in the CVHJV. The objective of this committee is to coordinate acquisition strategies to avoid overlap of habitat preservation programs. This is especially important for conservation easement programs because of the long-term nature of the acquisition process and the administrative complexity involved. Agencies and organizations listed under "Responsibility" in Table 5 may be subject to change as acquisition potentials and resources change among groups. Likewise, the acreages in Table 5 are preferred and may be subject to change as the CVHJV, is implemented.

Table 5. Estimated capital[4] cost for the habitat protection objective, Central Valley Habitat Joint Venture, North American Waterfowl Management Plan.

Estimated 1989 Action	Priority [1] Category	Responsibility	Cost (millions)
Yolo Basin			
E[2] - 5,000 Ac.	1	CDFG	5.0
American Basin			
E - 2,000 Ac.	1	CDFG	2.4
San Joaquin			
E-35,000 Ac.	1	USFWS	16.0
F-15,000 Ac.	1	USFWS/CDFG	34.0
E- 2,500 Ac.	3	USFWS	0.5
Tulare			
E- 5,000 Ac.	2, 3	USFWS	1.8
Butte Basin			
E-7,500 Ac.	1	USFWS	7.5
F- 640 Ac.	2	CDFG	2.0
E-1,860 Ac.	2, 3	USFWS	1.9
Delta			
F-2,300 Ac.	I	CDFG/USFWS	9.0
E-700 Ac.	1	CDFG	0.7
Colusa Basin			
E-1,850 Ac.	1	USFWS	2.2
E- 150 Ac.	2	USFWS	0.2
Sutter Basin			
E-500 Ac.	1	USFWS	0.6

Totals: 62,060 acres easement for $38.8 million[3]
17,940 acres fee for $45.0 million
80,000 acres $83.8 million

[1] Priority categories are defined as: 1) wetlands with traditionally high waterfowl use; 2) wetlands with low to moderate use by waterfowl but adjacent to lands potentially restorable to wetlands; and 3) wetlands with low to moderate use by waterfowl and not adjacent to lands potentially restorable to wetlands.

[2] E = easement, F = fee

[3] Private organizations will be involved in land acquisition on an individual project basis.

[4] See Appendix II for estimates of annual operations and maintenance costs.

Statement of Objectives

The two CVHJV objectives considered in this section are:

1. Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by the NWR's, State WA's, and the GRCD.

2. Secure CVP power for NWR's, State WA's, GRCD, and other public and private lands dedicated to wetland management.

Because the objectives for water and electrical power for wetland management are closely related, they are treated collectively in determining strategies and implementing actions.

The water and power identified in this objective are limited to the State WA's, the Federal NWR's, and the GRCD. Severe water and power shortages also exist on many privately owned wetlands, besides those in the GRCD. The water and power needs for these private wetlands, in addition to new or restored wetlands, will be addressed under the implementation actions for the other objectives. It is imperative that all water needs are fulfilled with water of suitable quality. The term "incremental", used in this objective acknowledges that water supplies need to be increased over a several-year period as delivery systems are improved to carry full objective-level flows.

Background

Water supplies for NWR's and WA's are insufficient. The current need for additional firm (contracted) water is 402,450 acre feet (Table 6).

The amount of water available to the refuges varies each year and commonly is not delivered at the time of year desired for appropriate wetland management. Typically, the refuges receive water only after all the agricultural, municipal and industrial demands are fulfilled. Currently, only the Mendota WA has a firm water supply in the amount considered necessary for the proper management of existing wetlands and facilities within the refuge boundaries. The remaining 13 State and Federal areas in the Central Valley and the GRCD must depend upon "when and if available" CVP supplies which include: 1) water that the BOR has under contract to customers but which customers cannot fully use at this time i.e., "interim" water; and 2) uncontracted firm project yield. At present, interim water supplies are declining 5 to 10 percent annually as irrigation districts increase their capacity to use this water. By the year 2020 it is anticipated that interim water will no longer be available.

Table 6. Water supply needs (in acre feet) for National Wildlife Refuges, State Wildlife Areas, and the Grasslands Resource Conservation District, in California's Central Valley.

Basin	Area	Level 1	Level 2	Level 3	Level 4	Obj.[3] Needs
Colusa	Sacramento NWR		46,400	50,000	50,000	50,000
Colusa	Delevan NWR	0	20,950	25,000	30,000	30,000
Colusa	Colusa NWR	0	25,000	25,000	25,000	25,000
Sutter	Sutter,NWR	0	23,500	30,000	30,000	30,000
Butte	Gray Lodge WA	8,000	35,400	41,000	44,000	36,000
	Total Sacramento Valley	8,000	151,250	171,000	179,000	171,000
San Joaquin	Grassland RCD[1]	50,000	125,000	180,000	180,000	130,000
San Joaquin	Volta WA	10,000	10,000	13,000	16,000	6,000
San Joaquin	Los Banos WA	6,200	16,670	22,500	25,000	18,800
San Joaquin	Kesterson,NWR	3,500	3,500	10,000	10,000	6,500
San Joaquin	San Luis NWR	0	13,350	19,000	19,000	19,000
San Joaquin	Merced NWR	0	13,500	16,000	16,000	16,000
Tulare	Mendota WA	25,000[2]	18,500	24,000	29,650	4,150
Tulare	Pixley NWR	0	1,280	3,000	6,000	6,000
Tulare	Kern NWR	0	9,950	15,050	25,000	25,000
	Total San Joaquin Valley	95,200	211,750	302,550	326,650	231,450
	TOTAL	103,200	363,000	473,550	505,650	402,450

Water Supply Level 1: Existing firm water supply

Water Supply Level 2: Current average annual water deliveries

Water Supply Level 3: Full use of existing development

Water Supply Level 4: To permit full habitat development

[1] As of 1985, Grassland Resource Conservation District no longer receives agricultural drainage flows because of water quality concerns.

[2] Only 18,500 acre-feet can be delivered to the Mendota WA without modifications of existing facilities.

[3] Objective level, additional firm water needs (Level 4 minus Level 1).

The exact amount of firm yield CVP water that is uncontracted is a matter of opinion but estimates generally range from 1 to 1.5 million acre feet. Public Law 546 has withheld the sale of 25 percent of this water until one

year after the Secretary of Interior completes the Refuge Water Supply Investigations Report and presents a recommendation to Congress.

Pumping of groundwater could, in part, alleviate the problem of water shortages; however, operating funds needed for pumping both ground water and surface water have not been sufficient to keep pace with escalating commercial power costs. The end result has been a reduction in wetland acreage. To date, CVP project-user power rates have not been available to wetland managers in the Central Valley because the authority needed to-provide such power is not clearly provided in existing legislation. Federal power rates, categorized as either project power, or preference power, are approximately 5 percent and 50 percent of the cost of commercial power, respectively. If CVP power were made available to wetlands at project rates, purchase of additional power needed to maintain, enhance and enlarge wetland habitats throughout the Central Valley would be more easily accomplished.

As demands for fresh water increase throughout the Central Valley, available supplies of surface water, groundwater, and agricultural return flows are expected to diminish. It is a consensus among refuge managers and wildlife biologists that without a dependable supply of water to maintain Central Valley refuge wetland habitat, waterfowl numbers could be significantly reduced in the near future.

Strategies to Accomplish Objectives

Actions needed to achieve these objectives are listed in Table 7. Actions are listed in priority order along with expected results; agency or organization having the lead in conducting the actions; general time frame to complete the actions; estimated cost and the organization to provide the needed funding.

Legislation was given the highest priority to meet the objectives because it would result in 100 percent attainment of objectives, could occur in a comparatively short time, and would not compete with other CVHJV funding needs. Activity has already begun to initiate such legislation. Other actions, identified with an asterisk, are likely to be implemented as components of the legislative action. If legislative action fails, then these actions will be independently pursued.

Administration and Coordination

The timing to achieve the objective for acquiring the firm water supply of 402,450 acre-feet is critical. BOR is currently in the process of determining allocation of approximately 1.5 million acre-feet of uncommitted water from the CVP. However, it is unlikely that the full requirement will be met from this source since total demand for uncommitted water is around 4 million acre-feet. Moreover, the BOR's decision on water allocation is not likely to occur within the next two years and could take much longer if legal actions delay the process. It is therefore critical that legislation, the top priority action to achieve the water objective, be introduced as soon as possible and, in any case, before the end of calendar year 1990.

Table 7. Actions and strategies to achieve water and power objectives, Central Valley Habitat Joint Venture, North American Waterfowl Management Plan.

Description of Action (Priority Order)	Expected Results	Lead Entity	Schedule	Cost
1. Initiate legislation reauthorizing the CVP to include wildlife as a project purpose. It would authorize and direct BOR and Western Area Power Administration to contract with USFWS, CDFG, and GRCD to provide needed water and power including any needed development costs. It would also include reduced power rates for other privately owned wetlands.	Fulfill 100% of objective.	CVHJV	Introduce legislation by 1991.	Borne by Entities
Develop a Refuge Water Supply Final Planning Report that describes the preferred procedure to achieve the water quantity objective	Needed as support material for legislators.	BOR	May, 1990	$185,000
2. Persuade the Secretary of Interior to direct BOR to provide 40,000 acre feet per year to the San Luis NWR complex per the 1950 agreement and the 1954 CVP reauthorization.	In conjunction with Kesterson mitigation water (12,000 acre feet) fulfills the water needs of this refuge complex (41,500 acre feet).	FWS	1990	Borne by Federal Government
*3. Support off-stream storage program. A trial program began in 1987-88 in the Grasslands and continued in 1988-89 and 1989-90. This involves storage of CVP water on duck clubs with spring releases for agricultural irrigation, in-stream fishery needs or other uses.	This procedure could work in both BOR and San Joaquin and Sacramento Valleys. Additional feasibility studies are needed.	CDFG & BOR	Ongoing	Borne by State, Federal & local agencies and private organizations

Description of Action (Priority Order)	Expected Results	Lead Entity	Schedule	Cost

4. Initiate legislation to reauthorize the CVP for fish and wildlife and include nonreimbursable water for wetlands and rivers - based partially on the mitigation for impacts of past CVP work. Mapping is needed to substantiate wetland losses since initiation of the CVP.	Fulfill 100% of water objectives.	CVHJV	Hold pending the outcome of Action #1. A wetland trend report for 1940 and 1980 was completed in fall of 1989.	Borne mainly by Federal Government
5. Persuade California State Water Resources Control Board to provide the needed water supply, based upon the public trust doctrine.	Such action unlikely in the future, but could result in achieving 100% of water objective.	CVHJV	Hold pending the outcome of Action #1.	Borne by State & Federal Government
6. Initiate legislation to reauthorize the CVP to provide power at project user rates to State, Federal and private parties for wetland purposes. In conjunction with this legislation, a revision in the contract between the Dept. of Energy and the Pacific Gas and Electric Co. is needed to facilitate power delivery to the needed points.	Full use of existing refuge wells would meet no more than 10% of objective needs. To evaluate the effects of increased groundwater use, more information is needed on the size of the ground water reservoir. The current assumption is that new wells could be used to supplement delivered surface water in drought years to meet objective needs.	CVHJV	Hold pending the outcome of Action #1.	Borne by State & Federal Government
*7. Seek reallocation of CVP water contracts. Contract on Friant Dam (Millerton Lake) water are now up for renewal.	Without legislative action or court direction, such reallocation is unlikely.	CVHJV	Hold pending the outcome of Action #1.	Estimated $10/acre foot.

Description of Action (Priority Order)	Expected Results	Lead Entity	Schedule	Cost

8. Purchase CVP water (no State water available) under contract.	Assuming 250,000 acre feet is available about 60% of objective level would be 402,450 feet.	BOR, FWS, & CDFG	Hold pending the outcome of Action #1.	Up to $3.75M annually.
9. Purchase water from water districts.	The amount of contract water currently available from water irrigation districts is being assessed.	CDFG	Hold pending the outcome of Action #1.	Unknown - depends on amount available and cost per acre foot.
*10. Support the use of groundwater recharge projects to provide wetland habitat. There is currently a proposal to do this in the Southern San Joaquin Valley.	Could provide all the water requirements for Kern and Pixley NWR's if flooding of these areas would significantly contribute to a groundwater recharge program.	CDFG	Feasibility studies ongoing	Most costs to be borne by development agency.
11. Support court actions to benefit wetlands. Lawsuits could develop over public trust, mitigation, and/or water rights.	Could result in attaining 100% of the water objective.	CVHJV	Opportunistic	Unknown, but considerable personnel time would be required.

* Footnote: These actions could be part of the overall strategy in Action #1.

Since total demand for uncommitted water is around 4 million acre-feet, BOR's decision on water allocation is not likely to occur within the next two years and could take much longer if legal actions delay the process. It is therefore critical that legislation, the top priority action to achieve the water objective be introduced as soon as possible and, in any case, before the end of calendar year 1990.

WETLAND RESTORATION OBJECTIVE

Statement of Objective

Increase wetland area by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easements. Because of the elaborate water delivery system in the Central Valley, this wetland creation could conceivably occur on lands that were not formerly wetlands; however, most restoration is anticipated on sites that were historically wetlands.

This objective is derived from the biological needs of waterfowl and is based on realistic expectations of the potential for restoration. The objective is broken down by basin in Table 8 and priorities established by a habitat deficit index, a measure of relative need.

Table 8. Wetland restoration objectives by basin for the Central Valley Habitat Joint Venture, North American Waterfowl Management Plan.

Basin	Priority	Habitat Deficit (%) Index [1]	CVHJV Objectives (Acres)
Sutter	1	275	11,000
American	2	250	10,000
Delta	3	200	20,000
Butte	4	131	34,000
Yolo	5	111	10,000
Colusa	6	55	15,000
San Joaquin	7	17	20,000
Tulare	-	0[2]	0
Suisun	-	0	0
TOTAL			**120,000**

[1] The habitat deficit index was calculated by dividing the total wetlands needed by the current wetland acreage in each basin, resulting in an index of relative need.

[2] The Hacienda Ranch and South Wilbur Flood Area are considered existing wetlands and are addressed under the wetland protection objective.

Past Efforts and Activities

Wetlands preservation and restoration programs have received increased attention in California in recent years. In the late 1970's, the California Legislature passed Senate Concurrent Resolution (SCR 28), which directed CDFG to develop a plan to protect, enhance, and restore California's wetlands. This document, "A Plan for Protecting, Enhancing and Increasing California's Wetlands for Waterfowl" was completed in 1983. Over the past five years, California voters have demonstrated continued commitment to protect wetlands by approving General Obligation Bonds totaling nearly $61 million to purchase interior wetlands. The USFWS identified the need to protect additional wetlands in California in its "Concept Plan for Waterfowl Wintering Habitat Preservation" in 1978 and again in the 1987 update. The wetland restoration chapter of the CVHJV Implementation Plan was developed from these CDFG and USFWS documents.

The starting point from which wetland additions will be counted toward the stated restoration objectives is January 1, 1986. By July 1989, a total of 7,300 acres have been permanently restored by the agencies and organizations of the CVHJV (Table 9).

Included are 4,000 acres of rice fields on privately owned duck hunting clubs in the Butte and Colusa Basin which were restored to native marsh under the USFWS's conservation easement program. Additionally, 2,300 acres of the Upper Butte Sink Unit of Gray Lodge WA were restored from rice to native marsh by the previous landowner prior to acquisition by the CDFG in late 1988.

Table 9. Wetlands restored in the California Central Valley, 1986-89.

Basin	CVHJV Objective (Acres)	Restored Acreage		Remaining Acres	
		Protected [1] 1986-89	Unprotected [2] 1986-89	To Restore	To Protect
Sutter	11,000	0	40	10,960	11,000
American	10,000	0	483	9,517	10,000
Delta	20,000	500	440	19,060	19,500
Butte	34,000	4,900	1,020	28,080	29,100
Yolo	10,000	0	255	9,745	10,000
Colusa	15,000	1,900	110	12,990	13,100
San Joaquin	20,000	0	20	19,980	20,000
TOTAL	**120,000**	**7,300**	**2,368**	**110,332**	**112,700**

[1] Purchased fee-title or conservation easement.

[2] Privately owned and not within any State or Federal easement program.

Approximately 400 acres have been restored at the TNC/DU Cosumnes River Preserve in the eastern Delta. Total holdings in the preserve are 1,500 acres, and more restoration is planned.

NAS has restored and manages 500 acres of freshwater wetlands at the Paul L. Wattis Audubon Sanctuary, west of Butte Creek. Additional acquisition and restoration by NAS in this area is anticipated.

Approximately 2,400 acres of habitat restored by private landowners (mostly in the Butte Basin) are shown in Table 9 as restored and unprotected because these wetlands have not been protected in perpetuity. This marsh restoration reflects the willingness of private landowners to develop wetlands for hunting purposes. Most owners have also indicated a willingness to sell conservation easements to permanently protect their restored habitat.

Justification

When waterfowl population objectives for the NAWMP are achieved, the number of birds wintering in the United States will more than double. There is evidence from high populations in the mid-1970's, and from bio-energetics calculations that existing habitat will be unable to adequately support an expanded population of this magnitude. With these higher population levels, current wetland acreages will be insufficient in size and the attendant crowding will escalate disease risks and lead to over-utilization of foods and other resources used by waterfowl in intensively managed wetlands.

Potential for Wetland Restoration by Basin

Criteria for all restoration acquisitions include the following: willing sellers, local government coordination, and a firm supply of acceptable water quality and quantity.

Other criteria that will be considered in the selection of specific projects are:

- Cost of Water Supply including both the short-term and long-term water costs.

- Cost of Conversion including the capital costs, presence of water-control systems, existing land use, topography, and access.

- Cost of Operation and Maintenance which is a non-capitalized annual expense.

- Adjacent Land use including conflicting or complementary land uses, the presence of toxic contamination, and any disease history or potential.

- Geographic Siting of Projects. This criteria consists of two elements. The preferred location of new projects will be at some distance from existing wetland areas to maximize waterfowl use of surrounding agricultural food resources and to stimulate private wetland development. This element is intended to be flexible to take advantage of opportunities provided by land donations or land availability from willing sellers. Second, some new projects will be close to existing wetlands to enhance their waterfowl value which otherwise would be limited because of area size, location, water supply or other site specific current restraints.

- Waterfowl Species Considerations. Some land will favor certain species by virtue of its habitat diversity, location, topography, potential to enhance local waterfowl production or to provide wintering habitat. Habitats and locations that benefit key target species such as northern pintail, mallards, and geese may receive priority in certain basins. The restoration effort also recognizes the value of associated uplands, especially for duck production and as forage for geese. However, when developing the total acreage for a new wetland acquisition, no more than 10 percent of any associated uplands within the wetland boundary will be used to compute the restored acreage.

- Other Wildlife Benefits. Consideration will be given to benefits for other wildlife in assigning value or priority to potential project areas. Riparian, vernal pool, and upland areas will be included in these assessments to permit acquisition of complete ecological units.

- Project Size. Acquisition of fee-title areas will include both those designed primarily as sanctuaries and those for multiple use. The preferred minimum size for sanctuary only areas is at least 1,000 acres. Multiple-use areas, including sanctuary and public use, should be greater than 2,500 acres in size.

- Cost and Benefits. Costs of acquisition, operation and maintenance, and potential benefits to waterfowl and other wildlife.

The following section provides descriptions of wetland restoration potential by basin:

Sutter Basin

Historically, the Sutter Basin was dominated by permanent and seasonal marshlands. Virtually all of this habitat has been lost to agricultural developments, and only Sutter NWR and a few small duck hunting clubs provide wetlands today. Because most of the land is rice fields, significant opportunities exist to restore marshes in the Sutter Basin.

There are two basic areas for wetland restoration in the Sutter Basin. The first is lands within the Bypass which offer the greatest potential because most of the land is presently in rice production and has existing water control facilities. Existing riparian corridors are suitable for enhancement of wood duck populations and other related wildlife. In addition, toe drains and ponds serve as valuable brood areas for ducks. The area southeast of Sutter NWR to the mouth of the Feather River at Verona offers significant wetland restoration potential because of its large size. The Tisdale Bypass, south of Sutter NWR also offers opportunities for wetland restoration. A negative aspect of wetland development within the Bypass is the damage to facilities that occurs from periodic flooding.

The second area for possible restoration is outside the Bypass and includes the large block of rice lands near Dingville; rice lands surrounding Sutter NWR; rice lands east and west of Robbins; and the oxbow lakes along the Sacramento River west of Robbins. Virtually all drainages within the Basin, including Gilsizer Slough, Sutter Bypass**,** and the Sacramento and Feather River have small associated sloughs that could provide a nucleus for wetland restoration. The primary beneficiaries of this type of development would be nesting populations of mallards and wood ducks, and wintering northern pintails, wigeon, teal, and geese.

American Basin

The American Basin offers great potential for restoration because virtually all of the original marshes are gone, its duck clubs contain little natural wetland habitat, and no public refuges or wildlife areas are present. This Basin offers several options for wetland development: 1) conversion of rice fields; 2) development in foothill drainages of ponds for duck brood use and winter resting; 3) conversion of irrigated and native pastures to wetlands; and 4) development and restoration of riparian forests.

The potential for substantial wetland restoration and development in the lower American Basin is especially high. Large tracts of rice fields and other irrigated croplands are available that are suitable restoration sites, and most have good water rights. Public sanctuaries would markedly increase the waterfowl carrying capacity of the area by providing rest sites for ducks and geese. Presence of increased numbers of birds in the sanctuaries would encourage development of private wetlands on surrounding lands and the flooding of rice fields for hunting. The lower Basin also presents opportunities to enhance habitat for Canada geese along the Sierra foothills. Geese and swans frequent the area in large numbers, using Folsom Lake and Camp Far West Reservoir as resting sites. Development of impoundments and associated marsh habitat in the hilly, lower elevations would expand the carrying capacity for geese and swans in this area. In the Olivehurst area, opportunities also exist to enhance waterfowl habitat on Beale AFB and surrounding rice fields.

Publicly owned wetlands are probably not necessary within District 10 (northeast of Marysville) because the area currently receives substantial waterfowl use and many of the private holdings essentially function as sanctuaries. In this area, wetland restoration can be achieved by private duck clubs using easement incentives. The entire District 10 area has great wetland restoration potential, as does the area immediately north of Honcut Creek.

The Yuba River Gold Field ponds and small lakes lying between District 10 and Olivehurst also present opportunities for wetland restoration to benefit wood ducks.

Sacramento-San Joaquin River Delta

Many wetland restoration opportunities exist in the Delta. There are no NWR's or managed WA's (management on Lower Sherman Island WA is custodial) in the Delta and most private duck hunting clubs are located on flooded grain fields. Wetland development opportunities are enhanced by the availability of good-quality water and gravity-flow delivery systems. Levee maintenance in the Delta can be expensive, and levee breaks could jeopardize wetland developments. Avian cholera also is a perennial waterfowl management problem that must be addressed in restoration plans.

East Delta should receive high priority because of its great potential for habitat development. The area includes tracts and islands on the eastern edge, including the Canal Ranch Tract, Bract Tract, Terminus Tract, and Staten Island. This area has minimal levee maintenance requirements, high availability of good water quality, and low cost gravity-flow water delivery systems. DU and TNC already own 1,500 acres in the Cosumnes River area between Interstate 5 and State Highway 99. There is also potential for wetland restoration in the Stone Lakes/Morrison Creek Area. The East Delta also has high-quality riparian areas that attract wood ducks, as well as islands of flooded agricultural fields and pastures that attract sandhill cranes and waterfowl.

Corn produced in the southern portion of the east Delta, including Rindge Tract, Empire Tract, Roberts Island, Lower and Upper Jones Tracts, Victoria Island, Union Island, and McDonald Tract, results in high waterfowl use. McDonald Island, in particular, has significant wetland restoration potential.

The central Delta (Bouldin, Venice, Mandeville, and Bacon Islands) receives high use by northern pintails, geese, and swans that use harvested corn fields and duck hunting club wetlands. Levee maintenance is a serious problem because of severe flooding, and Highway 12 through Bouldin Island would require continued maintenance by public utilities if this island was restored to wetland habitat. Mandeville Island (10,000 acres) offers especially great potential for wetland restoration because of single ownership and relatively inexpensive levee maintenance costs. A multipurpose water storage project proposed for Bouldin, Bacon, Webb and Holland Islands may affect the area's potential for wetland restoration.

Levees surrounding the West Delta islands experience severe erosion during floods and require careful maintenance to avoid excessive flooding. However, wetland restoration is possible in a few select locations. For example, the Department of Water Resources (DWR) is negotiating the donation of Sherman Island to CDFG as an alternative to DWR incurring the cost of providing overland water delivery facilities to the island farmers. This land could easily be restored to wetlands. Further, water quality is good and DWR would be responsible for levee maintenance.

Little Holland Tract, Ryer Island, Hasting Tract, Grand Island, Prospect Island, and Tyler Island in the North Delta also provide important marsh restoration opportunities. Restoration in this area would complement duck hunting club habitat already present in the Yolo Bypass.

Butte Basin

The Butte Basin has high potential for wetland restoration. Most natural wetlands are in the Butte Sink and Gray Lodge WA in the southern Basin, but a little wetland habitat exists in the central and northern Basin. Two immediate options are available: 1) conversion of rice fields to wetlands; and 2) restoration of riparian areas along Butte Creek, Parrot Ranch, and other Valley streams.

The highest priority for development of new habitat is in the central Butte Basin north of Highway 162 along Butte Creek. This area contains large acreages of rice fields that are underutilized by waterfowl for foraging because no nearby sanctuary exists. Establishment of sanctuaries would significantly increase waterfowl carrying capacity in the area and create incentives for private duck hunting club development. The Parrot Ranch, in particular, offers great potential for restoration of rice fields and riparian areas. The remaining areas along Butte Creek between the Gridley-Colusa Highway and Highway 162 also have good potential for restoration of rice fields and riparian areas.

The lower Butte Basin offers potential for w6tland restoration within and adjacent to the Butte Sink and Gray Lodge WA. The area is presently a nucleus for waterfowl in the Basin, and there is great interest in private duck hunting club development and enhancement. Restoration projects currently underway include the USFWS's conservation easement project in the Butte Sink, which has already restored about 2,200 acres and has the potential to restore an additional 1,000 acres. The "Bean Field," a 733-acre sanctuary owned by the USFWS, has been farmed for rice under an extended purchase agreement but will be converted to natural wetlands beginning in 1990.

The recently acquired Upper Butte Sink Unit of the Gray Lodge WA contains about 3,700 acres that will require restoration. The adjacent private lands also have good potential for wetland restoration once the WA is operational.

NAS recently purchased 500 acres of rice fields northwest of the Butte Sink that have been restored to natural wetlands and are managed as the Paul L. Wattis Audubon Sanctuary. Areas adjacent to the Butte Sink easement project and Gray Lodge WA also have a high potential for restoration. Several private duck hunting clubs west of the Butte Sink, notably the Behring Ranch, have converted rice fields to wetlands on their own initiative and have expressed interest in permanent protection through conservation easements.

Intermittent drainages surrounding the Thermalito Afterbay, and between Oroville and Red Bluff also have potential for small wetland development with dam construction. These areas would be valuable for local nesting, and could also support significant wintering concentrations of Canada geese and pintails.

Yolo Basin

The Yolo Basin offers several opportunities for significant wetland restoration, especially areas north of Interstate-5, west of the Yolo Bypass, and south of Interstate-80 along the Deep Water Ship Canal to the Delta. Waterfowl would benefit from establishment of one or two sanctuaries in these areas. Presently, waterfowl use of the Yolo Basin is sporadic. Better waterfowl use of rice fields in the western portion of the Basin would be achieved with a sanctuary near or in the Bypass. Expansion of duck clubs is expected to occur in the vicinity of any new public wetlands, and would contribute further to the enhancement of the Yolo Basin for waterfowl. Wetland development should be discouraged within the Yolo Bypass immediately west of Sacramento Metro Airport to avoid the danger of bird/aircraft collisions. Foothills along the western boundary of the North Basin also have potential for developing small “stockpond" reservoirs for local nesting habitat.

Colusa Basin

Wetland restoration potential is good to excellent in the Colusa Basin. Major areas of natural wetlands occur on NWRs and USFWS easement projects in the central Basin, but only small, remnant wetlands remain in the southern and northern sectors. Several options for development and restoration are available:

- Conversion of rice fields to wetlands;

- Construction of small dams on intermittent drainages in the foothills;

- Conversion of irrigated pastures to wetlands;

- Restoration of riparian areas.

The highest priority for development of new wetlands is in the southern Colusa Basin, south of the Grimes-Arbuckle Road. The area has little existing natural wetlands, but has high potential for conversion of rice fields. The post- harvest rice food base is underutilized because there are no sanctuaries nearby. Establishment of sanctuaries would significantly increase the waterfowl carrying capacity in the area and enhance development of private lands for duck hunting. There also exists great potential for wetland restoration of rice fields in the central Colusa Basin, within and adjacent to existing easement projects and refuges. The area is a nucleus of waterfowl distribution in the Basin, and there exists great potential for wetland development and enhancement on private hunting clubs, both-existing and potential. Several private duck hunting clubs have converted rice fields to wetlands on their own initiative and have expressed interest in permanent protection through conservation easements.

Restoration projects presently under way include the USFWS's easements in the Willow Creek and Lurline Creek areas, which have influenced the restoration of nearly 2,000 acres to date and have the potential to restore an additional 2,000 acres. The USFWS also plans to acquire and develop wetlands on approximately 1,200 acres of farmland that are presently inholdings at the south end of Colusa NWR.

Small, scattered areas of rice exist in the north Basin, near the Wilson Creek area north of Willows, and the Thomes Creek area north of Corning. Both have potential for wetland development. Intermittent drainages in the foothills throughout the Basin, especially in the Dunnigan Hills, and in the valley floor north of Orland, have potential for small wetland development through small dam construction. These areas would be valuable as pair and brood habitat for local nesting birds.

San Joaquin Basin

Wetland restoration in the San Joaquin Basin may be limited by availability of a firm, high-quality water supply. Areas within the San Joaquin Basin that have the highest potential for wetland restoration include rice fields in central Merced and northern Fresno counties. Agricultural lands adjacent to the San Joaquin River and surrounding the Grasslands Water District (GWD) duck clubs are also highly desirable for wetland restoration and would benefit existing wetlands in the GWD. Acquisition and restoration of a sanctuary near the southern division of GWD would help waterfowl dispersal in the region.

Significant opportunities exist for restoring wetlands in the East Grasslands north and south of Merced NWR. Most restoration could be accomplished through a proposed Federal conservation easement program. The San Joaquin River NWR and the adjacent State WA should be acquired as proposed. Within the San Joaquin Basin, habitat development should focus on dispersal of waterfowl.

Tulare Basin

No restoration is proposed in this document but this does not preclude future restoration efforts by public or private interests. Refer to the wetland protection section for a discussion of the Hacienda Ranch and South Wilbur Flood areas. These areas provide habitat only 3 years out of 10 when flood water is available.

Suisun Marsh

No restoration is proposed.

Strategies to Accomplish Objectives

Existing Programs

A significant private sector involvement will be necessary in the wetland restoration effort. About 75 percent (90,000 acres) of the proposed acreage is targeted for private ownership through perpetual conservation easements. The remaining 25 percent (30,000 acres) will be acquired in fee-title by the USFWS and the CDFG. Retention of the 75:25 private to public ratio will depend on private sector demand and interest, which is a function of recreational return on their investment. The public areas will serve as a nucleus around which private wetland development will be encouraged by offering permanent conservation easements.

Funding for fee and easement acquisition will come from a variety of sources such as: California State duck stamp funds, California Wildlife Restoration Fund, California Endangered Species License Plate Fund, D.U. MARSH funds, Federal Aid in Wildlife Restoration (Pittman-Robertson Act), private donations, cigarette taxes (Proposition 99), and California general obligation bonds. Based on past voter acceptance of habitat protection ballot measures, the majority of funding for the State portion of the restoration program will likely come from these sources. Federal funding will be provided by the Land and Water Conservation Fund, the Migratory Bird Conservation Account (duck stamps), and funds from the recently approved North American Wetland Conservation Act. It is anticipated that new sources of funding will also be developed to help implement the CVHJV. In addition, private organizations will acquire lands either for their own programs or for later transfer to Federal or State wildlife agencies.

Operation and maintenance costs of restored wetlands will be borne by the private sector on those lands under conservation easements. State lands acquisitions will use traditional sources of funding from the California Fish and Game Preservation Fund, Federal Aid, funding from initiatives, and General Fund nongame programs. The recently enacted Proposition 99 provides a new excise tax funding source that can also be used for this purpose. Federal wildlife refuge operation and maintenance funds are appropriated from general tax revenues.

New Programs

Many creative wetland restoration techniques and funding sources are available. Partnerships among resource agencies and private organizations can be used to facilitate wetland development. An example of this is the current DU-TNC project along the Cosumnes River. These new programs will use a variety of funding sources that include: 1) Federal or State appropriations for specific projects; 2) donations to the National Fish and Wildlife Foundation and matching grants; 3) land exchanges with, or donations from, the BLM, U.S. Forest Service, California Department of Transportation, Department of Defense, Farmers Home Administration (FmHA), and other land-holding agencies; 4) special fund-raising efforts by the private sector; 5) full use of the Food Security Act provisions for inclusion of wetlands and previously converted farmlands into the Conservation Reserve Program, and transfer of conservation easements or fee title on FmHA foreclosed property to wildlife agencies; 6) expansion of Federal conservation easement boundaries to encompass the entire Central Valley; 7) creation of a State conservation easement program; 8) use of mitigation land banks, provided such banks require that more wetland acreage is created than lost; 9) acquisition of land through bankruptcy proceedings; 10) endangered species tax check-off on State income tax forms; and 11) prospective State propositions to fund wetland restoration.

Cost and Time Schedule

A breakdown of capital costs to achieve the goal by basin is presented in Table 10. To achieve the stated objective of 120,000 acres, restoration of about 10,000 acres will be required each year through the year 2000. Private-sector land purchases for wetland conversion are not considered part of the costs and are not predictable.

Annual operation and maintenance costs of private wetlands may be partially borne by wetland enhancement programs of the CVHJV. These costs are expected to total $6.9 million after attainment of the restoration objectives in each basin. This figure includes $1.350 million ($15 per acre) from the State and Federal Governments to cover 90,000 acres of habitat management easements and $3.0 million ($100 per acre) from the State and Federal governments to cover the 30,000 acres acquired in fee-title. The private sector operations and maintenance contributions will total $2.25 million ($25 per acre) on the 90,000 acres of easement acquisition.

Administration and Coordination

A land acquisition coordination committee has been formed by the agencies and groups participating in the CVHJV. The objective of this committee is to plan habitat acquisition programs so that duplication of effort and competitive bidding does not occur. This is especially important for conservation easement programs because of the long-term nature of acquisition and the administrative complexity involved.

Table 10. Estimated capital[1] cost and time schedule for the wetland restoration objective, Central Valley Habitat Joint Venture, North American Waterfowl Management Plan.

Basin	Action (acres)	Responsibility	Schedule [2]	Estimated 1989 Cost (millions) [3]
Sutter	F (2,750) [4]	USFWS/CDFG		6.88
	E (8,250)	USFWS/CDFG		9.90
American	F (2,500)	USFWS/CDFG		6.25
	E (7,500)	USFWS/CDFG		9.00
Delta	F (4,875)	USFWS/CDFG		19.50
	E (14,625)	USFWS/CDFG		14.63
Butte	F (7,275)	USFWS/CDFG		21.83
	E (21,825)	USFWS/CDFG		21.83
Yolo	F (2,500)	USFWS/CDFG		6.25
	E (7,500)	USFWS/CDFG		7.50
Colusa	F (3,275)	USFWS/CDFG		8.19
	E (9,825)	USFWS/CDFG		12.77
San Joaquin	F (5,000)	USFWS/CDFG		5.00
	E (15,000)	USFWS/CDFG		6.00
TOTAL	F (28,175)			F 73.90
	E (84,525)	USFWS/CDFG		E 81.63
	112,700 Ac			155.53

F = Fee-Title Acquisition; E = Easement acquisition.

[1] See Appendix II for estimates of annual operations and maintenance costs.

[2] All acquisition is proposed for completion by the year 2000.

[3] Costs were estimated by basin. Estimated Fee acquisitions ranged from $1,000 per acre in the San Joaquin Basin to $4,000 per acre in the Delta. Estimated easements ranged from $400 per acre in the San Joaquin Basin to $1,300 per acre in the Colusa Basin.

[4] Acreage division between F and E reflect the 25:75 ratio between these types of acquisition.

WETLAND ENHANCEMENT OBJECTIVE

Statement of Objective

Enhance waterfowl wetland habitat on 291,555 acres of public and private lands. For the purposes of this document, enhancement includes management actions (supplemental funding, construction, or technical assistance) that promote: wetland availability (e.g., summer flooding, prolonged winter flooding); desirable plant and invertebrate communities; optimal foraging depths for a variety of waterfowl species; desirable spatial patterns of wetland vegetation and wetland types; and disease control efforts.

Background

Historically, abundant and diverse wildlife populations of the Central Valley were dependant on a vast wetland and riparian complex that was created by a natural hydrology of rainfall and snowmelt. This habitat complex comprised a variety of upland and marsh communities with diverse plant and animal populations and water regimes. Today, only 5 percent (291,555 acres) of the wetlands historically present exist and the remaining wetlands are dependant upon artificial flooding and management. This has resulted in less wetland diversity and has constrained waterfowl populations.

Of the 291,555 remaining wetland acres, 204,840 acres (70 percent) are in private ownership, 43,695 acres (15 percent) are in State ownership, and 43,020 acres (15 percent) are in Federal ownership. Only a general description of habitat conditions and enhancement activity of these remaining wetlands can be given because an objective and uniform system of evaluating and monitoring habitat conditions throughout the Central Valley is not available.

In the Sacramento Valley, over half of the existing 67,500 acres of wetlands are managed as seasonally flooded tule marsh (wetlands with significant amounts of tall, dense emergent cover), while about 40 percent of the acreage is managed as seasonally flooded moist-soil vegetation (wetlands dominated by short-statured, seed-producing annual plants). WA's and NWR's are intensively managed for waterfowl, and habitat conditions are generally good to excellent although funding is often inadequate for optimal enhancement. During dry years, water in quantities required for optimum habitat conditions on public areas is generally not available after January 1.

Some private duck hunting clubs in the Sacramento Valley are intensively managed for waterfowl, but habitat conditions are highly variable and there is a need for enhancement on individual wetlands. Much of this habitat is flooded before the hunting season and remains flooded until late winter, although some is deliberately dewatered following hunting season. With a few exceptions, all these wetlands are dependant on delivered water for flooding, and most irrigation districts shut down during winter which affects water availability during late winter and spring.

The Suisun Marsh is a substantial acreage of managed wetlands, where habitat conditions and enhancement activities are addressed under programs administered by the Soil Conservation Service and the Suisun Resource Conservation District. Expansion of these programs or new programs are not recommended as part of the CVHJV at this time.

Waterfowl habitat in the Delta has received little attention because most agricultural development occurred early in the century. Some waterfowl have benefitted from the agricultural practices of fall flooding harvested corn and
wheat fields for salinity suppression and weed control, but many have not. High flood risk, fluctuating water quality, large levees, land subsidence, logistical problems, and regulatory constraints all contribute to high costs
of waterfowl habitat management in most of the Delta. These problems are less severe on lands in the freshwater tidal zone in the eastern part of the Delta.

Some intensively managed wetlands exist in the Yolo Bypass duck hunting clubs, a few scattered clubs in the Delta, and recently, inlands on and adjacent to the Cosumnes River Preserve in southern Sacramento County.

In the San Joaquin Valley, about 60 percent of the 156,700 acres of native wetlands are managed as seasonally flooded moist-soil impoundments, while 30 percent are managed as seasonally flooded tule wetland. Wetlands in the West Grasslands are generally managed as open, shallow flooded ponds for northern pintails. East Grasslands wetlands are managed more for mallards and geese (more tule ponds, riparian areas, and native uplands). Private wetlands are flooded just before and during the hunting season and are dewatered soon after.

Wetlands in the San Joaquin Basin depend on delivered surface water and rainfall. Most irrigation districts do not deliver water during the December-February period because of general ditch maintenance. As a result, in drought years rainfall may be insufficient to maintain water levels in these wetlands. To solve this problem, irrigation districts will need to restructure maintenance operations to supply water during this period. Recently, 12 percent (18,717 acres) of the native wetlands were flooded until April as part of an offstream. water storage project. This project used wetlands as shallow water-storage reservoirs which provide waterfowl habitat and subsequent water releases for increased flows for fisheries.

In the Tulare Basin, most duck clubs are scattered and do not present the opportunity to develop enhancement strategies for large, contiguous blocks of habitat. Most clubs do not have access to delivered surface water, and are financially stressed by the cost of flooding with pumped ground water which ranges between $25 to $50 per acre foot.

Existing Programs Available for Enhancement

The Agricultural Conservation and Stabilization Service (ASCS) and SCS shallow-pond improvement program (WL-2) provides up to 50 percent of the cost ($3,500 maximum) for the improvement of water management on existing or restored private wetlands. The types of work covered include ditch, island, and levee construction, excavation, water-control structures, and some vegetative plantings. The ASCS and SCS administered Waterbank Program also offers a funding source for enhancement of waterfowl nesting habitat and some technical assistance in the major waterfowl areas of the Central Valley.

NWR's receive Federal appropriated funds for operation and maintenance (including enhancement), whereas habitat management activities on WA's are covered through State general funds, duck stamp receipts, Pittman-Robertson funds, and from DU MARSH funds. Some private duck hunting clubs have also received State funds and money from DU. In 1986, CDFG initiated an interim program to partially reimburse ($10/acre) wetland owners for the cost of maintaining wetland habitat in the Tulare Basin. Participants must have 75 percent of the eligible acres flooded from mid-November through late January. Approximately 2,000 acres were affected by this program in 1988-89.

Technical assistance to private wetlands owners in the Sacramento Valley and Delta is available from the USFWS, SCS, CDFG, CWA, DU, and private consultants. In the San Joaquin Valley, technical assistance to private duck hunting clubs in the GRCD is provided by biologists from the USFWS, SCS, and CDFG, who often cooperate and use a team approach to technical assistance. CDFG, USFWS, CWA, DU, and WHOA provide technical assistance to landowners in the Tulare Basin.

Regulatory agencies such as the Corps of Engineers and the Counties require permits (e.g. Section 404 of the Clean Water Act of 1977) for earth-moving work in wetlands. These regulatory activities are most evident in the Delta and affect dredge and spoil activities including marsh renovation work for waterfowl management. Mosquito abatement districts also impose restriction on water level manipulations to restrict mosquito production.

Strategies to Accomplish Objective

Enhancement of existing wetlands can be improved through increased funding for management activities on Federal, State, and private wetlands, coordination of extension efforts, and development of additional extension programs, advisory groups, demonstration areas, and field days that promote appropriate management actions. To ensure CVHJV's management goals are achieved on a site-specific basis, written contracts with management objectives, schedules for progress, acres affected, and evaluation should be developed for each project. Progress towards attainment of management objectives should also be monitored extensively via remote-sensing programs being developed by DU, CDFG, and USFWS.

Below are the CVHJV's suggested revisions for existing programs that allow or encourage wetland habitat enhancement activities:

- Increase funding to NWR's, State WA's, and private clubs for enhancement.

- Expand DU MARSH funding for Federal and private lands.

- Increase USFWS, SCS, DU, CWA, and CDFG staff to provide additional technical assistance to wetland owners throughout the Central Valley.

- Expand availability and funding for the SCS/ASCS shallow water improvement (WL-2) water bank programs; the USFWS habitat restoration program for CRP and easement properties; and the CDFG California Waterfowl Habitat (Presley) Program.

- Expand and continue State reimbursement program to private clubs in the Kern/Tulare area as part of the (Presley) Program.

Below is a list of new programs that should be initiated to enhance wetlands in the Central Valley:

- Develop written materials outlining Central Valley habitat management criteria.

- Improve coordination of technical assistance among organizations, agencies, and local conservation districts.

- Expand use of appropriate demonstration areas to illustrate innovative management techniques.

- Coordinate carcass removal activities during cholera and botulism outbreaks and increase funding for these activities.

A proposed cost and time schedule for CVHJV enhancement activities is listed in Table 11.

Administration and Coordination

Coordination of enhancement activities will be the joint responsibility of the Central Valley Habitat Joint Venture Technical Committee, and the various agencies, organizations, or private individuals who will conduct the actual management activities.

Table 11. Action and strategies to achieve the wetland enhancement objective, Central Valley Habitat Joint Venture, North American Management Plan.

Action	Expected Results	Lead Entity	Schd.	Cost
1. Increase supplemental funding to Federal and State Management areas.	86,715 acres @$25/ac./yr (30 percent of objective)	CDFG, USFWS	-	CDFG-$1,092,375 per year USFWS-$1,075,500 per year
2. Expanding available and funding for SCS/ASCS Waterbank Program in counties where program not currently available.	70,000 acres @ $25/ac.yr (24 percent of objective)	SCS	-	SCS - $10.5M per 10 years
3. Expand availability and funding for SCS/ASCS WL-2 Program by petitioning county committees and securing ACP money apportioned to WL-2.	30,000 acres (10 percent of objective)	SCS	-	SCS - $750,000 per year
4. Implement California Waterfowl Habitat (Presley) Program	100,000 acres @ $15/ac./yr (34 percent of objective)	CDFG	-	CDFG - $1.5M per year
5. Expanded DU Marsh program on private lands.	$30,000 acres @ $25/ac./yr (10 percent of objective)	DU	-	DU - $750,000 per year
6. New technical assistance personnel. *	-	USFWS (5 people) CDFG (4 people) SCS (4people) DU (2 people) CWA (2 people)	-	USFWS - $300,000/yr CDFG - $240,000/yr SCS - $240,000/yr DU - $120,000/yr CWA - $120,000/yr
7. Disease Management Work Team	-	CDFG (2 people & aircraft time)	-	CDFG - $2000,000/yr
8. Technical assistance coordination	-	CVHJV	-	Borne by respective participants

***** These personnel are needed to implement Actions 1-5.

AGRICULTURAL LAND ENHANCEMENT OBJECTIVE

Statement of Objective

Enhance waterfowl habitat on 443,000 acres of agricultural lands.

Background

Waterfowl in the Central Valley depend heavily on harvested grain fields for food and on wheat, hay, and set-aside lands for nesting. Certain pasture and haylands also provide new-growth grasses and sedges to grazing geese and wigeons in winter. Additionally, grasslands in foothill regions at the edges of the Central Valley provide excellent nesting habitat for many ducks. The existing 291,555 acres of wetlands in the Central Valley do not supply adequate food and cover for the populations of wintering waterfowl proposed in the NAWMP. Further, few areas of densely vegetated upland cover exist in close proximity to remaining wetlands. If the waterfowl population levels specified in the NAWMP are to be achieved, 332,300 acres of grain fields and 110,800 acres of upland nesting habitat will be required to satisfy the basic biological needs of foraging and reproduction. These lands are needed in addition to the native marsh habitat described in the protection, restoration, enhancement, and water supply objectives described previously. This objective specifically targets harvested grain, especially rice, and associated set-aside lands to meet stated goals. These rice and set-aside lands were targeted because of their proximity to major waterfowl concentration sites, the ease of working with a relatively small segment of the agricultural industry (i.e. rice programs and farmers, and the cost effectiveness of this approach. Future agricultural enhancement programs may be needed in hay, pasture, and range lands if the initial programs do not meet waterfowl needs.

The value of agricultural lands to waterfowl is greatly affected by crop type, land management techniques used during production and following harvest, weather, and location. Enhancement of agricultural lands for waterfowl offers much potential to offset shortfalls in food and nesting requirements. Because large blocks of agricultural lands are covered under provisions of current governmental price support and crop reduction programs, stipulations to require specific wildlife considerations on private lands may be used to enhance the values of many agricultural lands for waterfowl. Certain agricultural practices presently specified under current governmental programs, tend to increase use of pesticides and herbicides, and emphasize "clean farming" techniques, which increase costs for farmers and detract from the wildlife values of agricultural land. Major problems include tilling of harvested grain fields immediately following harvest in the fall and tilling, burning,
and mowing of set-aside lands.

Strategies to Accomplish Objective

Use of Existing Programs

The 1985 Food Security Act and its companion agricultural crop reduction programs include provisions for enhancement of agricultural lands for waterfowl. In 1987, over 790,000 acres of croplands were held idle as set-a-side lands in California; 392,000 acres of this was in wheat and rice fields, mostly in the Central Valley. Prior to 1988, many county ASCS committees required set-aside lands to be burned, tilled, or mowed annually to control noxious weeds. Additionally, many counties stipulated that if set-aside lands were flooded, future cultivation of them would violate "Swampbuster" provisions of the 1985 Food Security Act.

Recently, the California State ASCS Committee revised its policy for set-aside lands and now encourages: 1) seasonal flooding or other irrigation for periods of less than six months; 2) planting of small grains for wildlife consumption; 3) planting cover crops and trees; 4) refraining from tilling, burning, or mowing; 5) leaving lands fallow; 6) leasing lands for hunting; 7) leaving the same tracts of land in set-aside for more than one consecutive year; and 8) receiving compensation from non-ASCS sources for efforts expended for wildlife enhancement. Currently, these practices are voluntary and participation does not impose penalties or affect base acreage allocations. Continuation of the above policy changes by the State ASCS committee and their adoption by the local committees will greatly benefit nesting waterfowl and other associated upland-nesting wildlife. It is recommended that these policies on set-aside lands become mandatory for landowner participation in government subsidy programs. Specifically, new Federal legislation requiring multi-year contracts and establishment of vegetative cover on set-aside lands is desirable.

Section 1318 of the 1985 Food Security Act allows financially troubled farmers to restructure FmHA loans and cancel a portion of their debt by placing conservation easements on portions of their lands. Section 1314 may protect wetlands and other valuable habitats by placing deed restrictions on foreclosed inventory lands of FmHA. In addition to these programs on inventory lands, it seems desirable to establish requirements for land-use management on currently farmed FmHA lands. Restructuring loans in exchange for conservation easements on certain lands and requiring that farmers implement practices such as conservation tillage, no fall tilling, promoting vegetative cover on set-aside and idle lands, and flooding rice lands after harvest would greatly benefit wintering and breeding waterfowl in California.

New Programs

- Incentive Payments. Incentive payments are recommended for farmers who: 1) defer tillage of harvested croplands in fall and winter; 2) flood harvested fields from fall through late winter; and 3) leave set-aside lands fallow and encourage dense nesting cover. The incentive programs described below were determined to be feasible and acceptable to farmers from the results of a questionnaire sent to Sacramento Valley rice farmers and by input from State and Federal farm organizations, and agencies. A pilot program implementing these incentive programs on approximately 6,000 acres was started in the fall of 1989. This pilot program will manage at least 2,000 acres in each of the above three programs. Demonstration areas of about 1,200 acres each that include all incentive programs were located in the Colusa, Butte, American, and Sutter Basins and the Delta region. A fully implemented incentive program encompassing 443,089 acres is recommended subject to review of the 1989 pilot program and funding availability.

Incentive Program #1 - (deferred fall tillage) sets an incentive payment of $10 per acre to landowners who defer tillage of harvested grain fields, specifically rice and corn until at least 15 February. Participating landowners would be allowed to burn fields in accordance with county and State burning regulations. Full implementation of program #1 would encompass 83,075 acres distributed among basins (Table 12) relative to waterfowl distribution (Table 2). Location of this deferred-tillage acreage within a basin would be determined based on proximity to existing and future planned wetlands and waterfowl concentration areas traditionally used by geese, and past history of fall tillage.

Incentive Program #2 - sets payments of $10 per acre for lands with a history (3 of the past 5 years) of fall and winter flooding. For lands without a history of winter flooding, owners will receive $10 for each acre flooded, plus they will be paid for the cost of their water up to a maximum of $30 per acre. The goals of this program are to maintain 249,215 acres (Table 12) of harvested grain fields in deferred tillage plus winter flooding and to encourage farmers that have not traditionally flooded harvested grain fields to do so. The "three of the past five years" provision would require a newly flooded property to be flooded for 3 years before being classified as traditional and thus receiving the lower payment. Creation of two payment rates may encourage many farmers to seek leases from duck hunters, thereby increasing income from flooded fields. In 1988, approximately 60,000 acres of harvested grain fields were flooded. Consequently, incentive program #2 would enroll these 60,000 acres and an additional 189,215 acres not currently flooded (Table 12). The distribution of flooded lands within each basin will be based on landowner participation, location of historically flooded fields, and proximity to existing and planned wetlands and waterfowl concentration areas.

Landowners participating in program #2 will be required to flood harvested fields as soon after harvest as possible; maintain water levels in enrolled fields until 1 January; and not purposefully drain these fields until 15 February. Stubble in harvested fields may be burned, but not tilled, prior to floodup. Maintenance of water in fields until 1 January will be contingent upon availability of water from irrigation districts serving enrolled properties. Some irrigation districts do not deliver water after 1 December; however, most districts indicate that, if demand is great enough and water is available, they would continue to deliver water until at least 1 January. Lobbying for delivery of water by certain irrigation districts throughout winter will be necessary. Water may be purposefully drained from enrolled fields under special circumstances (e.g., a major disease outbreak) upon approval by consulting biologists. The 1989 pilot program will require that at least 200 acres in each demonstration area be maintained as sanctuary where no hunting is allowed. Landowners may allow hunting or lease hunting rights on the other flooded lands as desired.

Table 12. Area (in acres) of agricultural lands to be managed under three incentive programs in the nine drainage basins of the Central Valley of California.

	Incentive Program				
	Deferred Tillage	Winter Flooding	Set-aside Lands	Basin Total	Total Cost
Basin					
American	3,713	11,140	6,095	20,948	$ 334,805
Butte	24,050	72,151	12,631	108,832	1,900,019
Colusa	21,093	63,268	26,924	111,285	1,824,828
Delta	13,026	39,078	16,288	68,392	1,123,548
San Joaquin	-	-	15,290	15,290	152,900
Suisun	-	-	-	-	-
Sutter	11,282	33,845	12,631	57,758	958,336
Tulare	4,951	14,854	5,540	25,345	420,558
Yolo	4,960	14,879	15,400	35,239	519,779
Total	83,075	249,215	110,799	443,089	$7,234,781

Incentive Program #3 - sets a payment rate of $10/acre for encouraging dense nesting cover on set-aside lands.

Full implementation of this incentive program would involve 110,799 acres of set-aside lands (Table 12). The distribution of this managed set-aside among basins will be based on the distribution of rice and wheat set-aside acreage in the Central Valley. Distribution of set-aside enrolled within basins will be based on landowner participation and proximity to wetlands where pre-breeding and brood-rearing foods and cover are provided. Contracts issued in the 1989 pilot program will only require participation in 1989. If this incentive program is fully implemented, future contracts will require participation for three years. Tilling, burning, mowing, are prohibited. Spot spraying of herbicides to control noxious weeds is allowed as specified under local and State ASCS requirements. Participation will be flexible to accommodate changes in annual set-aside quotas required by the USDA. Special management of enrolled lands, such as fall mowing of travel lanes for wildlife, may be allowed, subject to approval by consulting biologists.

- Outreach Extension and Education

In addition to incentive payments to farmers, an extension and education program extending biological and agricultural information to landowners should be formally developed. This extension program would interface, and be coordinated with extension programs proposed under the wetland enhancement objective and with existing activities of CDFG, USFWS, CWA, DU, University of California Cooperative Extension, and USDA county representatives. The intention of this new outreach effort is to enhance and create wildlife habitat on private lands without involving public dollars for acquisition, easement, or management. Educational tasks included in this outreach effort include providing landowners with information on current or new land management techniques that benefit both farmers and wildlife, identifying financial assistance programs available to growers who use conservation land management, developing farm and wildlife management plans, preparing
information and education materials, and acting as liaison between agricultural and conservation interests within counties.

Administration and Coordination

Agricultural enhancement programs have been identified that: 1) mandate policy changes in existing USDA farm programs; 2) suggest legislation to impose multi-year contracts for set-aside acreage; 3) establish incentive programs for landowners that manage harvested grain fields and set-aside lands for the benefit of waterfowl; and 4) formally coordinate extension and education activities to inform and assist landowners interested in enhancing their lands for waterfowl. The following administrative and coordination strategies are recommended:

- Policy Changes: Changes in USDA farm program policy typically involve lobbying local, State, and national ASCS committees; county and State SCS personnel; farm-related organizations; and appropriate State and Federal legislators. The CVHJV includes representatives from many of the respective farm-related groups, and can collate necessary data and identify and write language for potential changes in policy. Organizations participating in the CVHJV should initiate this lobbying effort.

- Legislation: The CVHJV should identify or review new legislative proposals concerning integrated conservation and agricultural issues. The Implementation Board and participating organizations of the CVHJV should then lobby for support and passage of favorable legislation.

- Incentive Payments: Funds for the 1989 pilot incentive program were provided by CDFG and CWA. The 1989 pilot program will be reviewed by the CVHJV participants and subsequent changes, continuation or expansion will be recommended. Funds for full implementation of these incentive programs will be sought from CDFG, USFWS, USDA, and other private sources when appropriate. Staff and logistical support would be supplied by CWA, private foundations, and possibly CDFG, USFWS, or USDA. Eventually, administration of payments by county ASCS offices would be desirable.

- Outreach Technical assistance groups should be established in each basin of the Central Valley. These groups should include appropriate members from CDFG, USFWS, CWA, SCS, DU, and county resource conservation districts. Funds for staff participation should come from internal sources of the respective organizations and from private foundations.

Evaluation of Agricultural Enhancement Programs

All agricultural enhancement programs will be evaluated to determine compliance of participating landowners, vegetative responses to leaving set-aside lands fallow, waterfowl use of all agricultural lands, and general effectiveness in benefitting both farmer and waterfowl. The 1989 pilot program will be evaluated by searching set-aside fields for nests twice during spring 1990 to document nesting effort, density, and success relative to vegetation composition of fields; recording times of harvest, burning, and flood-up of lands enrolled under deferred tillage and winter flooding programs; checking water levels in flooded fields; and conducting aerial and ground censuses of waterfowl using flooded fields and designated sanctuary areas. Additionally, the USFWS and CWA are conducting radiotelemetry studies to evaluate fall through spring habitat use-by northern pintails and mallards throughout the Sacramento Valley. These research studies will help identify use of agricultural lands, spatial relationships between private and public wetlands, sanctuaries, and harvested rice fields. Additional monitoring and research efforts should accompany full implementation of the agricultural programs. This research should be coordinated and funded by the USFWS, CDFG, CWA, and universities.

EVALUATION AND MONITORING

Justification

When fully implemented, the CVHJV will affect activities on 950,000 acres of wetlands and agricultural lands at a capital cost of more than $528 million and an annual cost of about $38 million. The magnitude of these expenditures and acreage demands prudence in decisions about where, when, and how limited dollars will be spent. As implementation of the CVHJV proceeds, each step must be monitored and evaluated to assure that habitat and waterfowl population objectives are being met and that wise budgetary decisions are made. Midstream corrections are often necessary in new programs to guide progress toward the desired goal.

Certain monitoring of CVHJV progress is simple accounting of acres and waterfowl. Other monitoring and evaluation is less direct and involves answering basic questions about:

- Where should managed wetlands and agricultural lands be located?
- How large should individual parcels, and complexes, of managed habitat be?
- What type of management should be emphasized in each basin (and site within a basin) and in protected, enhanced, or restored wetlands and agricultural lands?
- What is the role of different habitats in meeting wintering and breeding waterfowl requirements and population objectives?
- What is the role of privately vs. publicly owned and managed habitats?
- What is the role of sanctuaries in various locations?
- When and how much water is needed for various management regimes?

Answers to some of the above questions are available for certain species, habitat types, and locations, however, much is unknown and integration of all CVHJV objectives is critically needed.

Within the CVHJV, three levels of monitoring and evaluation are proposed. The first, broadest, level is the entire area covered by the CVHJV. This valley-wide assessment will reflect contributions and progress of each objective toward meeting ultimate habitat and waterfowl goals. The second, stepped-downed, level is a regional, or basin, assessment. Regional perspectives are often the hardest to attain because of the complexity of interacting variables, yet they may be the most important toward understanding why and how CVHJV objectives and implementation strategies do, or do not, ultimately support more waterfowl. The third, most refined, level is site-specific. Achievement of the CVHJV objectives is ultimately accomplished by the cumulative protection, enhancement, and restoration of many local areas. Factors that influence the success of site-specific projects vary greatly by basin and objective. This variation must be recognized and understood to effectively design and guide implementation strategies.

Valley-Wide Assessment

A primary valley-wide need is to test the assumptions in Chapter 2 upon which many of the CVHJV objectives were based. As the assumptions are tested and refined, CVHJV activities can be focused on areas of greatest need for waterfowl.

At the broadest level, accounting of acres of land affected by objective, location, and year must occur. As implementation proceeds, lands that are protected, restored, and enhanced must be placed into perspective relative to seasonal and annual dynamics of habitat suitability, as influenced by climatic and hydrological factors, land use, and waterfowl abundance. Seasonal inventories of waterfowl habitat in the Central Valley are essential to fully monitor CVHJV progress. Inventories in fall, early winter, late winter, and mid-spring are necessary to monitor the extent of wetlands and harvested, flooded agricultural lands in relation to annual-cycle needs of waterfowl. Possible techniques to accomplish seasonal inventories include aerial transects, analyses of aerial photography, and remote sensing. Each of these techniques has advantages and disadvantages. Pilot studies to determine the most effective and cost-efficient, rapid monitoring technique are underway by USFWS, DU, and CDFG.

Seasonal monitoring of waterfowl populations in the Central Valley is also needed to assess population status, distribution, and habitat use in relation to these habitat factors. Currently, CDFG and the USFWS conduct monthly aerial censuses of waterfowl from September through January each year. In addition, one or two aerial surveys of breeding waterfowl are conducted in April or May. Fall and winter surveys should be continued and coupled with seasonal habitat inventories. Breeding surveys for California need to be redesigned to incorporate: 1) proper timing to coincide with major periods of nesting; 2) statistically reliable representation of breeding habitats; and 3) correction for visibility biases. Beginning in spring 1990, CDFG, CWA, and the USFWS will modify existing breeding surveys in accordance with these considerations and develop functional annual operational surveys by 1992.

If the Central Valley is to support more waterfowl, survival and reproductive potential of birds must be at levels that increase and maintain populations at desired numbers. To confirm this, annual survival and recruitment rates of waterfowl populations and subpopulations in California must be monitored. Survival rates are typically calculated using band recovery analyses. Such analyses are dependent on having adequate samples of birds banded annually in California and the Pacific-Flyway. Annual bandings identified in the USFWS "Banding Needs Document" and supplementary bandings identified by the Pacific Flyway Technical Committee must be accomplished.

The annual productivity of mallards nesting in California can be determined from field studies in selected areas and from age-ratio data obtained from hunter-killed birds. CDFG and CWA have conducted nesting studies in the Central Valley since 1985, and these studies provide baseline information on recruitment rates and dynamics. Continuation of CDFG and CWA nesting studies in selected basins and habitat types is desirable.

USFWS is currently conducting disease research at the Sacramento NWR complex. Results of this work should have valley-wide application and continuation of this work is desirable.

Regional (Basin) Assessment

The Central Valley encompasses a great diversity of geologic, physiographic, and climatic conditions. Hydrology, plant communities, and animal communities vary regionally and impose different constraints on the implementation of CVHJV goals and management potentials. While information on how waterfowl use wetland basins and agricultural lands at specific locations is partly known for the Central Valley, little information exists on waterfowl responses over larger regional areas.

Monitoring the CVHJV's progress at the regional level partly involves a subset of accounting from the valley-wide inventories; i.e. acres of habitat and waterfowl numbers in each basin in each season. At the regional level, however, evaluation must go beyond simple enumeration. As first-step, second-step, and future projects are developed in each basin, their effectiveness must be evaluated relative to total waterfowl numbers and distribution within that area. Key questions that need answers within each basin include:

- How does waterfowl use (species and numbers) vary among public and private wetlands, sanctuaries, and agricultural lands in winter and breeding?

- What is the optimal size of enhanced and restored wetlands and enhanced agricultural lands for waterfowl?

- Which management plan strategies are most successful in meeting requirements of waterfowl?

- What is the optimal distance of private wetlands and enhanced agricultural lands from existing and planned public wetlands and sanctuaries?

Information important for this evaluation can partly be obtained from seasonal waterfowl inventories outlined under "Valley-Wide Assessment." Many factors influence waterfowl use patterns, however, and more refined evaluations of waterfowl abundance and habitat use are needed. Regional assessments of wintering pintails and wintering white-fronted geese by the USFWS Northern Prairie Research Center (Dixon Field Station), and wintering and prebreeding mallards by CWA are presently being conducted with radiotelemetry. Completion of these studies by 1991-92 will provide important information for evaluation of CVHJV's initial actions and will provide direction for additional regional evaluations.

The USFWS is also conducting extensive studies on evaporation ponds and contaminants, particularly on the San Joaquin-Tulare Basins. These studies will also provide important data to guide the CVHJV's actions.

Local (site-specific) Assessment

Each project of the CVHJV will have its own local, regional, and valley-wide impacts. Each site-specific project must be evaluated on how well it did, or did not, achieve protection, enhancement, and restoration of a habitat and whether waterfowl benefitted from specific management activities. Factors that need evaluation for each site are:

- Cost (capital and annual)
- Risk of conversion to non-waterfowl habitat
- Water availability and quality
- Efficacy of management changes and scenarios
- Resource (food, cover) improvement
- Species that benefitted (how much and when)
- Wetland function or hydrological benefits
- Habitat and species diversity

Site-specific projects generally have a sponsoring or jurisdictional agency or organization. It should be the responsibility of those sponsoring groups to conduct biologically based, and unbiased, evaluations for their projects. Furthermore, the CVHJV should act in an oversight role for these evaluations. It is likely that information needed for evaluation may not be readily available for all sites. As such, specific research on wetland and waterfowl ecology may be needed and should be identified and coordinated by the respective groups.

Initial Evaluation by Objective

Objective 1 - Habitat Protection. Initial monitoring will include simple accounting of protected acres by location, size, ownership, implementation method, and basin deficiency index. Seasonal waterfowl use of protected (both easement and fee-title) lands will be monitored by aerial surveys and radiotelemetry studies. Critical items that need attention include: 1) how management of protected lands relates to ownership, and 2) water availability and quality, especially in the Tulare Basin. Furthermore, the status of existing and new programs and their funding bases must be vigilantly monitored.

Objectives 2 and 3 - Water and Power. The status of proposed legislation and accounting of water available to target areas will be monitored. Continuation of water-quality assessments at key locations in the Central Valley by the USFWS, CDFG, EPA, and BOR must continue. The ability of various water districts in the Central Valley to deliver water at needed times must be annually assessed. Cost of power by area will also be annually assessed.

Objective 4 - Wetland Restoration. Accounting of restoration by location, size, ownership, and basin deficiency index will occur annually. Restoration of wetlands can occur by many methods, as previously discussed; and the extent and success of each method must be determined. Lands restored will be monitored to determine vegetation development and waterfowl use relative to location, engineering and construction activities (e.g., unleveling), and disturbance and hunting pressure. This monitoring can be determined by seasonal habitat and waterfowl inventories and by radiotelemetry studies. Additionally, specific studies will proceed on selected sites.

Objective 5 - Wetland Enhancement. Because enhancement involves increasing resource values per unit area, evaluation must go beyond simple accounting of acres affected to include how and what type of management plans have been developed and implemented relative to location, size, ownership, and method. A specific need is to evaluate the proportion of wetlands flooded during critical periods of early fall (for early migrants), late winter (for prebreeding) , and spring (for breeding waterfowl). Because not all wetlands will have similar management recommendations, site-specific evaluations of water quality and quantity, vegetation and waterfowl responses, and diversity must be considered. The number of personnel to conduct technical assistance and outreach programs is currently insufficient and must be increased for maximum effectiveness. Consequently, monitoring the number of available personnel and their respective activities is needed.

Research on wetland ecology, biomass production, waterfowl nutrition, physiology and behavior, contaminants, and disease is proceeding and will provide certain standards for evaluation. Estimates of wetlands and agricultural lands needed to support desired populations of waterfowl were based on certain broad assumptions about how much food is potentially available to, and consumed by, waterfowl. These assumptions need to be tested in the various basins of the Central Valley and enhancement efforts evaluated in terms of meeting food production standards. Status of funding for incentive programs such as SB 1630 and the SCS Waterbank, and their direction, will be annually monitored.

Objective 6 - Agricultural Land Enhancement. Accounting of areas receiving various incentive payments by location will occur annually. Compliance and management by participating landowners, vegetative responses to leaving set-aside lands fallow, and waterfowl use will be monitored by field visits, seasonal habitat and waterfowl inventories, and radiotelemetry. Because harvested rice fields are often extensively used at night by foraging ducks, radiotelemetry studies of pintails (USFWS) and mallards (CWA) will evaluate nocturnal use of enrolled fields. Set-aside lands will be searched for nests twice each spring to document nesting effort, density, and success as well as describing vegetation composition of the fields. Timing of harvest, burning, and flooding of lands and checks of water levels in fields will occur. Status of funding for incentive programs will be annually monitored.

Evaluation and Monitoring Committee

The Technical committee of the CVHJV will serve to coordinate evaluation and monitoring activities. Scientific advisors from local universities, agencies, and private organizations will assist with certain evaluations and interpretations. Specific functions of this group will be to; 1) track accomplishments and provide annual reports to the CVHJV Implementation Board and NAWMP national office; 2) evaluate various CVHJV activities relative to items listed in this section; 3) review research needs and recommend future direction; and 4) make recommendations to the Implementation Board for any program modifications indicated during data review.

SUMMARY

The CVHJV is a "Year 2000" project that, when completed will result in a substantial improvement in the wetlands of the Central Valley of California. Eighty thousand acres of existing native wetlands will be protected in perpetuity by fee or easement acquisition (Table 13). All existing wetlands (291,555 acres) will be enhanced on both public and private lands. A total of 120,000 acres of former wetlands will be restored and 402,450 acre-feet of water will be secured with long term contracts for delivery to existing State wildlife areas, national wildlife refuges, and the Grasslands Resource Conservation District. In addition, 443,000 acres of private agricultural lands will be enhanced for winter feeding and nesting.

Total capital costs are estimated to exceed $528 million. Annual operation and maintenance costs are estimated to be approximately $38 million. Once completed, the objective of the CVHJV will be to support a peak population of 4.7 million ducks including 2.8 million pintails and 875 thousand geese and swans. At the objective level, the Central Valley would support 490,000 breeding ducks, including 300,000 mallards. In addition to waterfowl, many other-wildlife and plants including several State and Federal listed threatened and endangered species would benefit from the CVHJV's activities. Finally, additional wetland-based benefits including water quality, flood control, fisheries, aesthetics, education and research, and recreation will accrue as a result of the CVHJV.

Table 13. Matrix of-actions to Implement the Central Valley Habitat Joint Venture

Objective	Sacramento Valley					Sacramento-San Joaquin Delta		San Joaquin Valley		Total
	Butte Basin	Sutter Basin	American Basin	Colusa Basin	Yolo Basin	Delta	Suisun	San Joaquin Basin	Tulare Basin	
1. Protect 80,000 acres of existing wetlands	640(F)					2,300(F)		15,000(F)		17,940
Acres	9,360(E)	500(E)	2,000(E)	2,000(E)	5,000(E)	700(F)	0	37,500(E)	5,000(E)	62,060
Priority	5	8	2	7	1	6	9	3	4	80,000
2. Secure 402,450 (ac. ft.) of firm water for NWR's, WA's & GRCD										
NWR's	0	30,000	0	105,000	0	0	0	41,500	31,000	207,500
WA's	36,000	0	0	0	0	0	0	24,800	4,150	64,950
GRCD	------	------	------	------	------	------	------	130,000	------	130,000
Priority	4	3	N/A	5	N/A	N/A	N/A	2	1	402, 50
3. Restore 120,000 acres of wetlands & protect with easements or fee purchase										
Acres	29,100	11,000	10,000	13,100	10,000	19,500	0	20,000	0	112,700
Priority	4	1	2	6	5	3	_	7	-----	
4. Enhance 291,555 acres of existing public and private wetlands										
Acres										
Federal		2,590		20,450			1,100	16,580	2,300	43,020
State	8,600					3,500	10,900	8,590	12,105	43,695
Private	17,550	500	3,150	5,985	8,700	5,850	46,000	95,130	21,975	204,840
Priority	4	1	2	6	5					
5. Enhance habitat on 443,100 acres of agricultural lands										
Acres	108,832	57,758	20,948	111,285	35,239	68,392	0	15,290	25,345	443,100
Priority	4	1	2	6	5	3	------	7	---------	

APPENDIX I

Glossary of Terms and Acronyms

BLM	-	Bureau of Land Management
BOR	-	Bureau of Reclamation
CDFA	-	California Department of Food and Agriculture
CDFG	-	California Department of Fish and Game
CVHJV	-	Central Valley Habitat Joint Venture
CVP	-	Central Valley Project
CWA	-	California Waterfowl Association
DOW	-	Defenders of Wildlife
DU	-	Ducks Unlimited
DWR	-	Department of Water Resources (California)
Enhancement	-	Management actions that promote wetland availability (e.g., prolonging flooding through later winter and spring migration), desirable plant and invertebrate communities, optimal foraging depths for a variety of waterfowl species, desirable spatial patterns of wetland vegetation and wetland types, and disease control efforts.
Firm Yield Water	-	Water that is delivered under a long term U.S. Bureau of Reclamation contract or is available under a water right.
FmHA	-	Farmers Home Administration
GRCD	-	Grasslands Resource Conservation District
Interim Water	-	Firm Central Valley Project water that the Bureau of Reclamation has under contract to customers but which customers cannot fully use at this time; surplus water in wet years; intermittent yield.

Intermittent Water	-	Surplus water in wet years
NAS	-	National Audubon Society
NWI	-	National Wetland Inventory
NWR	-	National Wildlife Refuge
Protected	-	Habitat owned in fee by a public (Federal, State, County) agency or privately owned wetlands that have a perpetual conservation easement.
Restoration	-	The process whereby wetlands are recreated on former wetland sites that have converted to non-wetland land uses.
SCS	-	Soil Conservation Service
Suitable Quality Water	-	Water that has sufficient quality such as (temperature or chemistry) to sustain the long-term biological integrity of a wetland system.
SWP	-	State Water Project
TNC	-	The Nature Conservancy
TPL	-	Trust for Public Lands
Unprotected	-	Any privately owned wetland not covered by a perpetual conservation easement.
USFWS	-	United States Fish and Wildlife Service
WA	-	Wildlife Area
Wetlands	-	Land where saturation with water is the dominant factor determining the nature of soil development and the types of plants and animal communities living in the soil and on its surface.
WHOA	-	Waterfowl Habitat Owners Alliance
WMA	-	Wildlife Management Area

APPENDIX II

Projected Implementation Costs [1] for the
Central Valley Habitat Joint Venture
(Cost Allocation by Funding Source)

Objective 1 - Protect 80,000 additional acres of existing privately owned wetlands through acquisition of fee-title or perpetual conservation easements.

Implementation Strategy - Acquire approximately 17,940 acres of existing wetlands in fee to be split between USFWS and CDFG at an estimated ratio of 60:40. Expand present USFWS conservation easement program to include all Central Valley counties and initiate a compatible CDFG permanent easement program. The ratio of USFWS: CDFG easements on existing wetlands is estimated to be 88:12 (Table 5, page 48). The estimated average cost of an easement is $625/acre based on a weighted average of land values that range from $1330/acre in Colusa Basin to $200/acre in the San Joaquin Basin (Table 5, page 48).

Cost Allocation:		**Cost**	**Source**
a. Capital Costs			
Fee Acquisition (17,940 acres total @ $2500/ac)			
6,965 acres by CDFG		$22,000,000	CDFG
10,975 acres by USFWS		23,000,000	USFWS
Conservation Easement (62,060 acres total @ $625/ac)			
7,700 acres by CDFG		8,100,000	CDFG
54,360 acres by USFWS		30,700,000	USFWS
Landowner Contribution			
62,060 acres @ $1500/ac		93,100,000	Private
	Sub-Total	$176,900,000	
b. Annual Cost [2]			
- 3 field biologists for easement administration		$150,000	USFWS
- 5 realty positions and 1 Joint Venture Coordinator		350,000	
USFWS position in Sacramento.		50,000	CDFG
	Sub-Total	$550,000 [3]	

[1] Appendix II show only the costs for implementing new programs needed to meet the objectives of the CVHJV. Appendix II does not include the costs of current programs such as base O & M funding for State WA's, Federal NWR's, and private duck hunting clubs.

[2] Annual O & M costs of managing 80,000 acres of Objective #1 wetlands (both fee and easement) are included in Objective #5.

[3] The $550K annual cost is current year level (1990) which will increase incrementally as USFWS and CDFG expand both fee and easement programs Valley-wide. At full implementation CDFG and the Wildlife Conservation Board will need 5 positions to administer their easement program. These positions and costs appear under Objective #4.

Objective 2/3 - Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality

and is delivered in a timely manner for use by the NWR's, WA's and the GRCD. This water is in addition to the 121,713 acre feet of firm supply currently available to these areas. Secure CVP power for NWR's, State WA's, GRCD and other public and private lands dedicated to wetland management.

Implementation Strategy - Sponsor the necessary State and Federal legislation.

Cost Allocation:	**Cost**	**Source**
a.Capital Costs	$35,353,730 [1]	USBR
Sub-Total	$35,353,730	
b. Annual expense:		
1) Operations and Maintenance (including local conveyance fees and electrical power)		
Sacramento Valley	$1,630,005 [1]	USBR
San Joaquin Valley	3,111,500 [1]	USBR
2) Surface Water		
Sacramento Valley (171,000 ac. ft. @ $5.00/.ac-ft.)	427,500 [1]	USBR
San Joaquin Valley (231,450 ac. ft. @ $15.00/ac-ft.)	1,735,875 [1]	USBR
Sub-Total	6,904,880	USBR

[1] Costs were derived from the "full ground water alternative" presented in the USBR's, "Report on Refuge Water Supply Investigations, March, 1989". As such, it represents the worst-case (i.e., most expensive) alternative in the report. See Appendix VI for a more detailed breakdown of these costs.

Objective 4 - Increase wetland area by 120,000 acres and protect these wetlands in perpetuity through

acquisition of fee-title or conservation easements.

Implementation Strategy - 90,000 acres (75% of total objective) will be developed in private ownership and permanent restoration achieved by the use of conservation easements. The average estimated cost of these easements is $965/acre and ranges from $400 to $1300 per acre (Table 10, page 67). In addition, annual wetland enhancement payments are estimated at $15/acre. Easements will be split between CDFG and USFWS in a 75:25 ratio. The remaining 25% of the objective (30,000 acres) will be acquired and managed by State and Federal agencies at an estimated capital cost of $2625/acre, including development costs of $250/acre. Annual operations and maintenance (O & M) costs for fee-title lands managed by a public agency are estimated to be $100/acre. Annual O & M costs for easement lands, managed by the private sector, are estimated at $40/acre of which $15/acre would be paid to the landowner through State, Federal, or private incentive programs and the remaining $25 would be paid by the owners or lease holders who would manage these wetlands primarily as duck clubs.

Cost Allocation:

		Cost	Source
a.	Capital Costs		
	1. Conservation Easement (90,000 acres [1] @ $2625 [2]/acre)		
	State Contribution = 67,500 acres @ $965/acre	65,135,500	CDFG
	Federal Contribution = 22,500 acres @ $965/acre	21,712,500	USFWS
	Landowner Contribution = 90,000 acres @ $1660/acre	149,400,000	Private
	2. 15,000 acres in fee title State ownership @ $2,625 [2]/acre =	39,375,000	CDFG
	3. 15,000 acres in fee title Federal ownership @ $2,625 [2]/acre =	39,375,000	USFWS
	Sub-Total	$314,998,000	
b.	Annual Costs		
	1. Conservation Easements (90,000 acres @ $40/acre)		
	State Contribution = 67,500 acres @ $15/acre	1,012,500	CDFG
	Federal Contribution = 22,500 acres @ $15/acre	337,500	USFWS
	Landowner = 90,000 acres @ $25/acre	2,250,000	Private
	2. 15,000 acres in State fee title ownership @ $100/acre =	1,500,000	CDFG
	3. 15,000 acres in Federal fee title ownership @ $100/acre =	1,500,000	USFWS
	4. 5 field positions to administer CDFG easement program	300,000	CDFG
	Sub-Total	$6,900,000	

[1] 7,300 acres have already been restored and protected; therefore, the balance of the objective is 82,700 acres.

[2] To calculate capital costs, it is assumed that acquisition and development costs for fee title lands equals the appraised value of the easement lands plus construction cost

Objective 5 - Enhance waterfowl wetland habitat on 291,555 acres of public and private lands.

Implementation Strategy - Increase current O & M funding on State and Federal Areas from $75/acre to $100/acre. Provide incentive payments to private landowners. Expand the DU MARSH program. Increase technical assistance and disease management capability.

Cost Allocation :	**Cost**	**Source**
a. Capital Costs		
1. Expand SCS/ASCS WL-2 Program to 30,000 acres @ $25/acre	750,000	USDA
2. Expand DU MARSH program 30,000 acres @ $25/acre	750,000	Private
Sub-Total	$1,500,000	
b. Annual Costs		
1. O & M Augmentation for existing public wetlands owned in-fee		
Federal = 43,020 acres @ $25/acre	1,075,500	USFWS
State = 43,695 acres @ $25/acre	1,092,375	CDFG
2. O & M funding for newly acquired fee lands from Objective #1		
Federal = 10,975 acres @ $100/acre	1,097,500	USFWS
State = 6,965 acres @ $100/acre	696,500	CDFG
3. Expand SCS/ASCS Waterbank Program to 70,000 acres @ $15/acre	1,050,000	USDA
4. Implement the California Waterfowl Habitat (Presley) Program, 100,000 acres @ $15/acre	1,500,000	CDFG
5. Increase technical assistance capability		
USFWS (5 people)	300,000	USFWS
CDFG (4 people)	240,000	CDFG
SCS (4 people)	240,000	USDA
DU (2 people)	120,000	Private
CWA (2 people)	120,000	Private
6. Increase disease management capability		
2 people plus aircraft time	200,000	CDFG
Annual Total	$7,731,875	

Objective 6 - Enhance waterfowl habitat on 443,000 acres of agricultural lands.

Implementation Strategy - Provide incentive payments to landowners according to the following

acreages and payment rates.

Cost Allocation:	**Cost**	**Source**
a. Capitol Cost	0	-
b. Annual Cost		
Deferred tillage - 833,075 acres @ $10/acre	830,750	CDFG 25%
Winter flooding 249,215 acres @ 21.25/acre	5,295,041	USFWS 25%
Set-aside 110,799 acres @ $10/acre	1,107,990	USDA 25%
		Private 25%
Sub-Total	$7,233,781	

Objective 7 - To monitor and evaluate all CVHJV implementation actions to ascertain how well they meet the intended objective and assess the cost effectiveness of such actions.

Implementation Strategy - Monitoring and evaluation will be done by the Joint Venture partners involved in actual implementation of each objective. Monitoring and evaluation costs are estimated to be 2% to 51 of the annual project costs. These costs are included in the cost allocations for Objectives 1 through 6.

Cost Allocation	**Cost**	**Source**
a. Capitol Costs	0	0
b. Annual Costs		
Included in the cost allocations for Objectives 1 through 6.		

SUMMARY

	Federal			State		
	USFWS	**USBR**	**USDA**	**CDFG**	**Private**	**TOTAL**
A. Capitol Costs						
Objective #1	53,700,000	0	0	30,100,000	93,100,00	176,900,000
Objective #2/3	0	35,353,730	0	0	0	35,353,730
Objective #4	61,087,500	0	0	104,510,500	149,400,000	314,998,000
Objective #5	0	0	750,000	0	750,000	1,500,000
Objective #6	0	0	0	0	0	0
Objective #7	0	0	0	0	0	0
Objective #8	0	0	0	0	0	0
	114,787,500	35,353,730	750,000	134,610,500	243,250,000	528,751,730
B. Annual Costs						
Objective #1	500,00	0	0	50,000	0	550,000
Objective #2/3	0	6,904,880	0	0	0	6,904,880
Objective #4	1,837,500	0	0	2,812,500	2,250,000	6,900,000
Objective #5	2,473,000	0	1,290,000	3,728,875	240,000	7,731,875
Objective #6	1,808,445	0	1,808,445	1,808,445	1,808,445	7,233,780
Objective #7 [a]	- - [b] -	- - [b] -	- - [b] -	- - [b] -	- - [b] -	- - [b] -
Objective #8						
	6,618,945	6,904,880	3,098,445	8,399,820	4,298,445	29,320,535

[a] Annual monitoring and evaluation costs will be 2-5% of the annual O & M for each objective and are included in annual costs for objectives 1-6 above.

[b] Annual costs for the communications/public affairs objective will be determined later and appended to this summary.

Cost Allocation

1. Capitol Cost	-	Federal	150,089,123	28.4%
		State	134,610,500	25.5%
		Private	243,250,000	46.1%
2. Annual Costs	-	Federal	16,622,270	56.7%
		State	8,399,820	28.6%
		Private	4,298,445	14.7%

APPENDIX III

Benefits Derived from the Protection, Restoration, and Enhancement of Central Valley Wetlands Relative to Their Environmental Functions [1]

Wetland Value	Wetland Function
Flood Conveyance	Riverine wetlands and adjacent floodplain lands often form natural floodways that convey flood waters from upstream and downstream points.
Barriers to Waves and Erosion	Costal wetlands and those inland wetlands adjoining larger lakes and rivers reduce the impact of storm tidal waves before they reach upland areas.
Flood Storage	Inland wetlands store water during floods and slowly release it to downstream areas, lowering flood peaks.
Sediment Control	Wetlands reduce flood flows and the velocity of flood waters, reducing erosion and causing flood waters to release sediment.
Fish and Shellfish	Wetlands are important spawning and nursery areas and provide sources of nutrients for commercial and recreational fish and shellfish industries, particularly in coastal areas.
Habitat for Waterfowl and other Wildlife	Both coastal and inland wetlands provide essential breeding, nesting, feeding and predator escape habitats for many forms of waterfowl, other birds, mammals, and reptiles.
Recreation	Wetlands serve as recreation sites for fishing, hunting, and observing wildlife.
Water Supply	Wetlands are increasingly important as a source of ground and surface water with the growth of urban centers and dwindling ground and surface water supplies.
Food Production	Because of their high natural productivity, both tidal and inland wetlands have unrealized food production potential for harvesting of marsh vegetation and aquaculture.
Timber Production	Under proper management, forested wetlands are an important source of timber, despite the physical problems of timber removal.
Historic, Archeological Values	Some wetlands are of archeological interest. Indian settlements were located in coastal and inland wetlands which serve as sources of fish and shellfish.

Appendix III
(cont.)

Education and Research	Tidal, coastal, and inland wetlands provide educational opportunities for nature observation and scientific study.
Open Space and Aesthetic Values	Both tidal and inland wetlands are areas of great diversity and beauty and provide open space for recreational and visual enjoyment.
Water Quality	Wetlands contribute to improving water quality by removing excess nutrients and many chemical contaminants. They are sometimes used in tertiary treatment of wastewater.

[1] Adopted from Kusler, 1983. Our National Wetland Heritage

APPENDIX IV

Wetland Dependent Endangered, Threatened, and Candidate Species
(State and Federal) of the Central of the Central Valley, California

Common Name	Scientific Name	Classification
	PLANTS	
Henderson's Bentgrass	Atriplex tularensis	FC
Forked Fiddleneck	Atriplex vallicola	FC
Large-Flowered Fiddleneck	Brodiaea insignis	
Suisun Aster	Calycadenia fremontii	FC
Valley Spearscale	Calycadenia hooveri	
Bakersfield Saltbush	Caulanthus californicus	FC
Lost Hills Saltbush	Chamaesyce hooveri	FE, SE
Kaweah Brodiaea	Cirsium crassicaule	FPE
Fremont's Rosinweed	Clarkia rostrata	FPT
Hoover's Rosinweed	Clarkia temblorensis ssp.	FC
California Jewelflower	calientensis	FC, SE
Hoover's Spurge	Cordylanthus mollis ssp.hispidus	FC
Slough Thistle	Cordylanthus palmatus	FE, SE
Beaked Clarkia	Eremalche kernensis	
Caliente Clarkia	Eriastrum hooveri	FC
	Erynzium pinnatisectum	FC, ST
Hispid Bird's-Beak	Eryngium racemosum	FC
	Eryngium spinosepalum.	FC
Palmate-Bracted Bird's Beak	Erysimum capitatum var.	
Kern Mallow	augustatum	FC
Hoover's Wooly-Star	Eschscholzia rhombipetala	FC
Tuolumne Coyote-Thistle	Fritillaria striata	FPE
Delta Coyote-Thistle	Hibiscus californicus	FC, SR
Spiny-Sepaled Coyote-Thistle	Juncus leiospermus var.	FC, SE
Contra Costa Wallflower	leiospermus	
	Lathyrus jepsonii ssp. jepsonii	FC, SE
Diamond-Petaled Poppy	Legenere limosa	
Greenhorn Adobe-Lily	Lembertia congdonii	FE, SE
California Hibiscus	Lilaeopsis masonii	
Red Bluff Rush	Limnanthes floccosa ssp.	
	californica	
Delta Tule-Pea	Neostapfia colusana	
Legenere	Oenothera deltoides ssp. howellii	
San Joaquin Wolly-Threads		
Mason's Lilaeopsis		
Butte County Meadowfoam		
		FC
Colusa Grass		FC
Antioch Dunes evening-		FE, SE
primrose		FC
		FC
		FC, SE
		FC
Agrostis hendersonii		FC, SE
Amsinckia furcata		FC
Amsinckia grandiflora		FC
Aster chilensis var. lentus		FPE, SE
Atriplex joaquiniana		FC

Appendix IV. (cont.)

PLANTS

Common Name	Scientific Name	Classification
Bakersfield Cactus	Opuntia treleasei	FPE
San Joaquin Orcutt Grass	Orcuttia viscida	FC, SE
Pilose Orcutt Grass	Orcuttia pilosa	FC, SE
Slender Orcutt Grass,	Orcuttia tenuis	FC, SE
Sacramento orcutt grass	Orcuttie viscida	FC, SE
Fleshy Owl's-Clover	Orthocarpus campestris var. succulentus	FC, SE
Merced Phacelia	Phacelia ciliata var. opaca	FC
Hartweg's Pseudobahia	Pseudobahia bahiaefolia	FC, SE
Tulare Pseudobahia	Pseudobahia peirsonii	FC, SE
Valley Sagittaria	Sagittaria sanfordii	FC
Arburua Ranch Jewelflower	Streptanthus insignis ssp. lyonii	FC
Caper-Fruited Tropidocarpum	Tropidocarpum capparideum	FC, SR
Greene's Orcutt Grass	Tuctoria greenei	FE
Solano grass	Tuctoria mucronsta	

CRUSTACEANS

Conservancy Fairy Shrimp	Brachinecta - new species	FC
Vernal Pool Branchinecta	Brachinecta - new species	FC
California Linderiella	Linderiella occidentalis	FC

INSECTS

Valley Elderberry Longhorn Beetle	Desmocerus californicus dimorphus	FT
Sacramento Valley Tiger Beetle	Cicindela hirticollis abrupta	FC

FISHES

Winter-Run Chinook Salmon	Oncorhynchus tshawytscha	SCT

AMPHIBIANS

California Tiger Salamander	Ambystoma tigrinium californiense	FC

REPTILE

Giant Garter Snake	Thamnophis couchi gigas	FC, ST

Appendix IV (cont.)

BIRDS

Aleutian Canada Goose	Branta canadensis leucopareia	FE
Bald Eagle	Haliaeetus leucocephalus	SE, FE
Swainson's Hawk	Buteo swainsoni	ST
American Peregrine Falcon	Falco peregrinus anatum	SE, FE
California Black Rail	Laterallus jamaicensis cotruniculus	ST
California Clapper Rail	Rallus longirostris obsoletus	SE, FE
Greater Sandhill Crane	Grus canadensis tabida	ST
California Least Tern	Sterna antillarum browni	SE, FE
Western Yellow-billed Cuckoo	Coccyzus americanus occidentalis	SE
Bank Swallow	Riparia riparia	ST
Least Bell's Vireo	Vireo bellii pusillus	SE, FE
Suisun Song Sparrow	Melospiza melodia maxillaris	SCE
Tricolored Blackbird	Agelaius tricolor	FC
White-faced Ibis	Plegadis chihi	FC

MAMMALS

Salt Marsh Harvest Mouse	Reithrondontomys raviventris	SE, FE
San Joaquin Kit Fox	Vulpes macrotis mutica	ST, FE
Riparian Brush Rabbit	Sylvilagus bachmani riparius	FC
Buena Vista Lake Shrew	Sorex ornatus relictus	FC
San Joaquin Woodrat	Neotoma fuscipes riparia	FC
Suisun Shrew	Sorex ornatus sinuosus	FC

SR = State Listed Rare
SE = State Listed Endangered
ST = State Listed Threatened
FE = Federally Listed Endangered
FT = Federally Listed Threatened
SCE = State Candidate (Endangered)
SCT = State Candidate (Threatened)
FPE = Federally Proposed (Endangered)
FPT = Federally Proposed (Threatened)
FC = Federal Candidate
FR = Federal Recommended

APPENDIX V

Central Valley Refuge Water Costs to Provide Level 4 Supplies Based on Full Groundwater Capability [1]

Area	Alternative	Annual Cost: Acre Feet [2]	Capital Cost: Const. Costs	Annual Cost: Operations & Maintenance [3]	Annual Cost: Surface Water Cost [4]	Annual Cost: Total Annual Costs
Sacramento NWR	4E	50,000	5,412,500	423,000	125,000	548,000
Delevan NWR	4C	30,000	2,133,200	238,730	75,000	313,730
Colusa NWR	4B	25,000	1,244,600	218,175	62,500	280,675
Sutter NWR	4D	30,000	1,121,250	480,600	75,000	555,600
Gray Lodge WA	4D	36,000	275,500	269,500	90,000	359,500
Total Sacramento Valley		**171,000**	**10,187,050**	**1,630,005**	**427,500**	**2,057,505**
Grasslands GRCD	4B	130,000	13,284,000	1,216,000	975,000	2,191,000
Volta WA	4B	6,000	330,500	37,000	45,000	82,000
Los Banos WA	4B	18,800	704,300	204,850	141,000	345,850
Kesterson NWR	4F	6,500	493,900	48,250	48,750	97,000
San Luis NWR	4C	19,000	3,749,000	224,150	142,500	366,650
Merced NWR	4C	16,000	423,880	177,420	120,000	297,420
Mendota WA	4B	4,150	515,500	174,190	31,125	205,315
Pixley NWR	4D	6,000	1,794,600	158,300	45,000	203,300
Kern NWR	4D	25,000	3,871,000	871,340	187,500	1,058,840
Total San Joaquin Valley		**231,450**	**25,166,680**	**3,111,500**	**1,735,875**	**4,847,375**
Total		**402,450**	**35,353,730**	**4,741,505**	**2,163,375**	**6,904,880**

[1] Based on the conjunctive use alternatives presented in the U.S. Bureau of Reclamation's "Report on Refuge Water Supply Investigations", March, 1989.

[2] This is the amount of water in excess of existing firm supplies required to maintain refuge habitat levels. (Level 4 minus Level 1.)

[3] O & M costs include power for pumped ground water, local conveyance fees, and annual maintenance of facilities. These costs were multiplied by a factor of 0.5 based on the assumption that groundwater would be used 5 out of 10 years.

[4] Surface water costs were calculated using an average 1990 cost of $4.87 per acre foot in the Sacramento Valley and $14.89 in the San Joaquin Valley. (B. Shaffer, USBR memo dated 3-27-90) which were rounded to $5.00 and $15.00, respectively, for simplification. These values were multiplied by a factor of 0.5 based on the assumption that surface waters would be used 5 out of 10 years.

APPENDIX VI

SIGNATURE PAGE

IMPLEMENTATION BOARD:

Daniel Chapin — 4/17/90
Daniel Chapin, Vice President, Government Affairs,
California Waterfowl Association — Date

Richard Sparks — 4/17/90
Richard Sparks, California Representative,
Defenders of Wildlife — Date

4-17-90
John Nagel, Regional Operations Supervisor/
Marsh Coordinator, Ducks Unlimited — Date

Glenn Ellen Olson — 4-17-1990
Glenn Olson, Vice President, Western Region,
National Audubon Society — Date

William C. Unkel — 4-17-1990
William C. (Chris) Unkel, Director,
California Wetland Program, The Nature Conservancy — Date

4-17-90
Mike Mater, Executive Vice President,
Waterfowl Habitat Owners Alliance — Date

EX-OFFICIO BOARD MEMBERS:

Pete F. Bontadelli — 4-17-90
Pete F. Bontadelli, Director,
California Department of Fish and Game — Date

Harriett Burgess — 7/17-90
Harriett Burgess, Senior Vice President,
Trust for Public Lands — Date

Marvin L. Plenert — 4/17/90
Marvin L. Plenert, Regional Director,
U.S. Fish and Wildlife Service — Date

United States Department of the Interior
FISH AND WILDLIFE SERVICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO:
FWE/NWI
Mail Stop 60120

Memorandum

To: Joint Venture Coordinator, Central Valley, FWS,
Sacramento, California

From: Regional Wetland Coordinator, FWS, Denver, Colorado

Subject: Atlas of National Wetlands Inventory Maps for Kidder County, North Dakota

The National Wetlands Inventory (NWI) produces maps throughout the United States at a 1:24,000 scale as a standard product. These maps are made available to many Federal, State and private concerns for a variety of wetland applications. Over 65 percent of the contiguous United States have NWI final maps available. Oftentimes users request that NWI maps be presented in different formats, such as color coded maps, various scales, watersheds or other geographical or political subdivision basis.

In November 1989, the Denver Regional Office produced NWI maps and wetland acreage statistics in an atlas format for Kidder County, North Dakota. The selection of Kidder County for the first county atlas was based on several reasons: (1) Kidder County is in the middle of the Prairie Pothole Region with obvious important waterfowl priorities; (2) the entire area was digitized so that wetland acreage data were available; and (3) if an atlas on a 14" by 17" format could be successfully produced for high wetland density areas such as the Prairie Pothole Region then atlases for other parts of the country should also be successful.

For your review and recognition of potential application of similar map products within your Joint Venture area, attached is a copy of "Atlas of National Wetlands Inventory Maps for Kidder County, North Dakota." Also attached is a list of the other Joint Venture Coordinators who received copies of the "Atlas of National Wetland Inventory Maps for Kidder County, North Dakota." If you have any questions, call me at (303) 236-2985 or FTS 776-2985.

Chuck Elliott

Attachments

Identical Memorandums were sent to (see Attachment)